# BELL TELEPHONE QUARTERLY

VOL. XIX JULY, 1940 NO. 3

TWO DECADES OF VAIL MEDAL AWARDS

ANOTHER WAR GAME TEST OF BELL SYSTEM SERVICES

CONVENTIONS AND COMMUNICATIONS

SUN SPOTS AND TELEPHONE SERVICE

THE CONQUEST OF A CONTINENT

TELEPHONE STATISTICS OF THE WORLD

AMERICAN TELEPHONE & TELEGRAPH CO. • NEW YORK

# BELL TELEPHONE QUARTERLY

*A Medium of Suggestion and a Record of Progress*

VOL. XIX JULY, 1940 NO. 3

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THE THEODORE N. VAIL MEDAL FOR NOTEWORTHY PUBLIC SERVICE

# TWO DECADES OF VAIL MEDAL AWARDS

*They Perpetuate the Late Theodore N. Vail's Ideals, and Recognize Employees' Devotion to the Public Service, Through Bestowal of Medals for Outstanding Acts*

By CHARLES J. SCHAEFER, JR.

TWENTY years ago the death of Theodore N. Vail, who at that time was Chairman of the Board of Directors of the American Telephone and Telegraph Company, brought to a close the career of one of the outstanding figures in the development of the telephone in America. The Theodore N. Vail Memorial Fund was established soon thereafter to provide awards each year to telephone employees throughout the United States in recognition of noteworthy acts conspicuously illustrating the high ideals which governed Mr. Vail's policy of public service.

The Memorial in honor of Mr. Vail is administered by trustees on the basis of a broad concept of the telephone business. The awards for noteworthy acts and service of "employees of the Bell System" apply to all telephone workers engaged in the various agencies through which the System furnishes telephone service to the public. Thus it is that, in addition to awards to Bell telephone employees, a number of awards have been made over the years to employees of subsidiary and affiliated companies, connecting companies, agency offices, and private branch exchanges. Those charged with the administration of the Memorial not only have been trustees of the Fund itself but have also safeguarded the application of the Fund to the ideals and traditions on which it is founded.

To those familiar with the Bell System, these ideals are a continuing tradition of the business. Almost daily, among the more than 450,000 telephone workers in this country, acts are performed by employees which strikingly illustrate these ideals of service that go beyond the ordinary requirements of the job. As long recognized and often expressed, this thought of *service first* is more than devotion to an organization, inspiring as that may be. It derives from a sense of individual responsibility in the public service; it is a dedication to the highest ideals of duty and obligation in that service; it comes from intelligent recognition of the vital importance of telephone service in the lives of others and to the safety and well-being of the community; it is devotion to the whole telephone de-

This Certifies that the special award of a gold medal offered under the terms of the Theodore N. Vail Memorial Fund and known as the

THEODORE N. VAIL MEDAL

for Noteworthy Public Service

has been made to

Mildred Lothrop

Chief Operator, Homer, Nebraska.

For noteworthy public service, in the face of increasing personal danger and public disaster, displaying the highest courage, loyalty and devotion in saving human life.

After midnight of May 31, 1920, receiving word of an approaching flood, she took her place at the switchboard, warning the people to flee for safety and calling for help from the surrounding country, continuing her efforts until the rising water disabled the switchboard, when she barely escaped from the flooded building.

THE FIRST NATIONAL GOLD MEDAL AWARD CERTIFICATE

mocracy—to the thousands of fellow-employees whose coöperation, direct and indirect, makes individual accomplishment possible, and to the millions forming the telephone-using public who have built up their social and industrial fabric around and in reliance upon good telephone service.

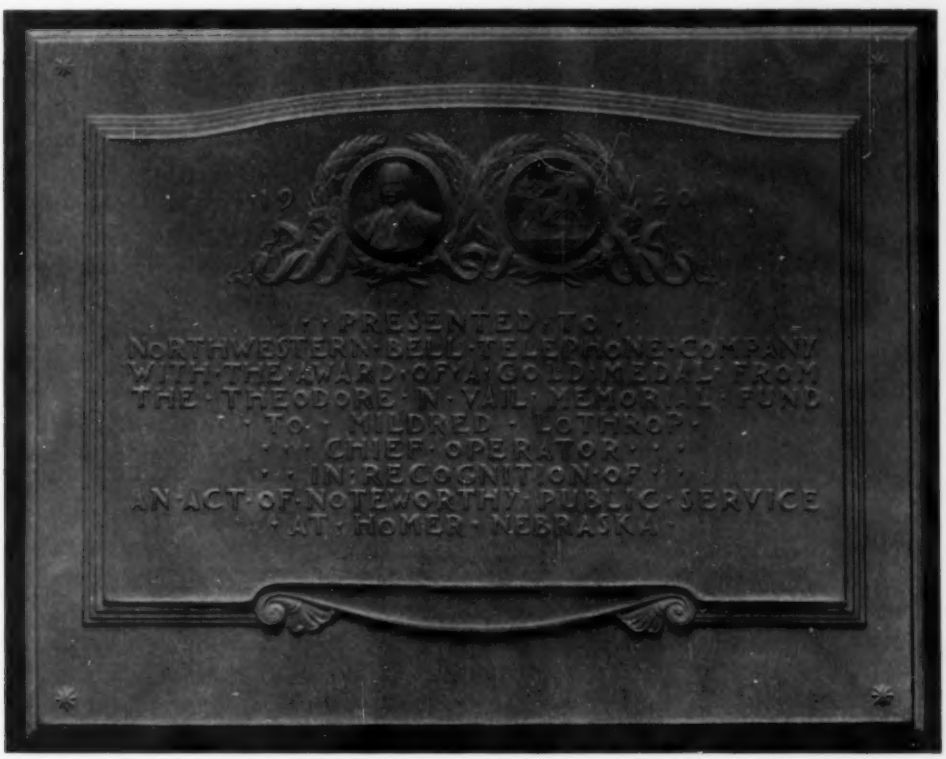
### *Medals of Bronze, Silver, Gold*

THE Memorial Fund provides a continuing plan for giving recognition to employees for acts of conspicuous service in emergencies through the award of bronze, silver, and gold medals, with accompanying citations. Cash awards of $250 are included in silver medal cases, and $500, or for a very exceptional act $1,000, in gold medal cases. In addition to these awards, bronze plaques are presented as a permanent and public memorial to the companies in which employees receive gold or silver medals, and special bronze plaques have been awarded in certain cases of noteworthy public service on the part of groups of employees where it was not possible to single out one or more persons for individual awards.

Committees of Award are appointed by the presidents of the Bell System Companies to consider all potential cases for award occurring each year within their respective territories, in-

cluding cases of employees in subsidiary, affiliated, and connecting companies. After carefully reviewing each case, these Committees select the bronze medal award winners in their territories. These awards are then submitted to a Bell System Committee, appointed by the president of the American Telephone and Telegraph Company, which reviews them and any other cases which may be brought to its attention. Awards of gold or silver medals, and in some instances special plaques for groups, are made by the Bell System Committee in those cases which are considered to be of such conspicuous merit as to justify this higher recognition.

While telephone employees, like other citizens, often qualify for awards outside the Bell System, usually based on heroism or particular achievement, the Vail Medal Awards are distinctive in that the acts which they recognize are associated in some way with the telephone service, either by the use of telephone equipment or facilities or through training or experience gained in the telephone business. The usual elements which in varying degrees enter into the consideration of cases are initiative, re-


PRESENTED TO
NORTHWESTERN BELL TELEPHONE COMPANY
WITH THE AWARD OF A GOLD MEDAL FROM
THE THEODORE N. VAIL MEMORIAL FUND
TO MILDRED LOTHROP
CHIEF OPERATOR
IN RECOGNITION OF
AN ACT OF NOTEWORTHY PUBLIC SERVICE
AT HOMER NEBRASKA

A BRONZE MEMORIAL PLAQUE

*Plaques such as this are presented to companies whose employees receive gold or silver medal awards. This one was given to the Northwestern Bell Telephone Company in connection with the first national gold medal award, shown on the opposite page*

sourcefulness, courage, fortitude, and accomplishment. Some acts or services may include certain of these elements to an outstanding degree without being especially noteworthy with respect to other of these characteristics. However, there is usually a direct or indirect combination of most of these qualities in the higher awards.

Since the establishment of the Vail Memorial, awards have been made as follows:

VAIL MEDAL AWARDS TO EMPLOYEES

| | Gold | Silver | Bronze | Total |
|---|---|---|---|---|
| Bell Associated Companies | 8 | 78 | 966 | 1,052 |
| Subsidiary Companies | 1 | 3 | 5 | 9 |
| Affiliated Companies | 0 | 2 | 16 | 18 |
| Connecting Companies | 0 | 5 | 22 | 27 |
| Private Branch Exchanges | 2 | 0 | 1 | 3 |
| Total | 11 | 88 | 1,010 | 1,109 |

Of the above totals, there have been individual awards of gold medals to seven men and four women; silver medals to 49 men and 39 women; and bronze medals to 670 men and 285 women.

In addition to these individual awards, bronze medals have been awarded to 55 employee groups, from which 24 group cases have been selected for special bronze plaques in recognition of devotion to duty and outstanding achievement in maintaining vital telephone service or in the restoration of essential facilities in floods, earthquakes, and hurricanes involving widespread disasters.

### *Instances of Public Service for Which Awards Have Been Made*

IT is, of course, impossible to include in an article of this length the many outstanding cases in which awards have been made over the past score of years. In view of the many different kinds of meritorious acts and the distinctive qualities of each, it is even difficult to select individual cases which give a comprehensive illustration of the general scope of the awards.

Such acts range from rendering important service to individuals in preventing or alleviating suffering to those related to widespread disasters in which vital communications, essential in saving lives and property and in effecting relief measures, were made possible by self-sacrificing devotion to duty. This is often accomplished in the face of extreme hazards by individual employees or by groups acting jointly in teamlike efforts. However, certain cases are cited below, without any attempt to distinguish relative merits with respect to the hundreds of other equally noteworthy cases, merely to typify these recurring acts for which the Vail Medal Awards provide deserved and lasting recognition.

HERE, for instance, is the case of a plant man in one of the Bell Companies which illustrates the spirit of service of those who build and maintain the lines.

A severe blizzard covered the entire state of Wyoming, from November 4 to November 8, 1922, causing breaks in the transcontinental telephone line west of Cheyenne. On the morning of November 7, the employee, although he was unfamiliar with the country west of Cheyenne, volunteered to go out ahead of the regular line crew and attempt to clear as much of the trouble as possible on the transcontinental line. The storm

was still raging. Climbing poles, he worked along the line for eleven miles on foot before he was able to secure a horse from a ranch near that section of the line. He then was able to cover a total of thirty-five miles.

After being out in the storm for thirteen hours without food, he called the Cheyenne Wire Chief and was advised of another break in the line three miles farther along. The horse was exhausted and could go no farther, so the employee waded through deep snow until he reached the break, which he was able to repair, thereby completing through coast-to-coast service on the transcontinental line on the evening of a state election.

Returning, he found the horse, and then called the Wire Chief in Cheyenne, who advised him of an emergency shelter three miles from where he then was. He was finally successful in reaching this shelter about midnight. He put his horse in the stable and then, as he tried to break in the door of the bunk house, collapsed in the snow. Here he was found later and rescued by a fellow-employee. The Vail Memorial Award in this case was a gold medal and $500.

ANOTHER case, that of a chief operator in a midwestern city, is a manifestation of noteworthy public service on the part of the "weavers of speech."

While supervising an emergency call to the police shortly after 9:00 A.M., December 16, 1930, the chief operator overheard the report of a bank robbery. About the same time several calls came in from people in the vicinity of the bank, telling of the hold-up and that five bandits were fleeing in a northwesterly direction in an automobile. She immediately took a position at the switchboard and notified the sheriff and the police and civil authorities of all the towns located in the general direction taken by the bandit car. She gave a description of the car to subscribers throughout the countryside, many of whom had noted it speeding by. Thus she learned the exact route of the bandits. She kept in constant touch with all their movements, even though on various occasions the bandits commandeered other cars and changed their course, and quickly relayed all information to the authorities.

The original posse of two cars and eight men was quickly augmented by others closing in on the bandits from all directions, and the latter part of the chase was a running gun battle. The bandits were never able to break through the spreading circle of intelligence which the chief operator kept ahead of their flight. After a pursuit of more than 50 miles, and within two hours of the robbery, the posse surrounded the bandits in a barnyard and a large number of police and citizens engaged them in the final battle. Three bandits were killed and the other two captured, and the entire loot was recovered. The Vail Memorial Award was a silver medal and $250.

AN illustration of noteworthy public service on the part of large groups of employees is the splendid performance of Bell System people who contributed to the maintenance and restoration of service during and following the September 21, 1938, hurricane in the Northern Atlantic States.

This was the worst catastrophe ever to strike that area. In a brief few hours it took 682 lives and destroyed more than $500,000,000 worth of property. The Bell System suffered the greatest damage to outside plant and the largest number of service interruptions in its history. Approximately 600,000 telephones were silenced, and telephone damage amounted to about $10,000,000.

Confronted with this unparalleled test, the Bell System promptly mobilized its organized resources to meet the emergency. Large quantities of standardized materials for the vast job of reconstruction were swiftly made available, and trained employees from various parts of the Bell System quickly responded to the need by supplementing the efforts of their fellow-employees in the stricken area. Through their combined and untiring efforts, crippled plant was soon restored to service, emergency circuits were installed for public and relief purposes, and restoration was accomplished with skill, ingenuity, teamwork, unity of purpose, and courage.

A special bronze plaque was awarded for this self-sacrificing devotion to duty under most trying and difficult conditions. The inscription on the plaque is, in part, as follows:

IN RECOGNITION OF
LOYALTY, DEVOTION TO DUTY
AND ACHIEVEMENT

---

THE HURRICANE OF SEPTEMBER, 1938

---

THEIR MERITORIOUS ACTS
CONSPICUOUSLY EXEMPLIFY
THE HIGH IDEALS AND TRADITIONS
OF PUBLIC SERVICE

And so the story might be told of numerous other cases where those who operate and safeguard the channels of intelligence have unselfishly responded to emergency needs of humanity. It must be realized, however, that there are, in addition to these employees who have been selected for special recognition, thousands of their fellow-workers who daily do their part in less conspicuous but equally essential ways in rendering personalized service to society which exceeds the nominal call of duty. Such incidents are inherent in the business. The standing of a company, as measured by the quality of service, is dependent on the extent to which employees individually and collectively recognize that the company's traditions, policies, and accomplishments are their own and that the results attained reflect to the credit of each and the satisfaction of all.

### *Ideals of the Service*

IT is this service feature of the "product" of the business which makes it more than an article having mere physical qualities and which has led to the opportunities for the kind of service exemplified by the Vail Medal Awards. Those who have had experience in telephone work realize that there is an *esprit de corps* which has been maintained in the business, despite enormous expansion and universal usage. The linemen and others who keep the wires alive in time of flood, fire, earthquake, and other disasters do not measure their efforts solely by the yardstick of material accomplishments in extending relief to

AWARDED TO
EMPLOYEES OF THE
BELL SYSTEM
BY THE NATIONAL COMMITTEE OF AWARD
THEODORE N. VAIL MEMORIAL FUND
IN RECOGNITION OF
LOYALTY DEVOTION TO DUTY AND ACHIEVEMENT
THE HURRICANE OF SEPTEMBER 1938
THEIR MERITORIOUS ACTS CONSPICUOUSLY EXEMPLIFY
THE HIGH IDEALS AND TRADITIONS OF PUBLIC SERVICE

A SPECIAL GROUP AWARD

*Plaques such as this are awarded in cases of especially noteworthy public service on the part of groups of employees where it is not possible to single out one or more persons for individual awards. This plaque was presented after the hurricane of September, 1938*

stricken communities—they rise to the human needs of the occasion, and their traditional spirit of service is a most important element in the relief they render. The operators who, sometimes in the face of personal danger, give warning to save others, who instinctively offer urgently needed advice regarding aid or sources of assistance in emergencies, instil a spiritual value in the service far beyond that which is possible in the mere functioning of the inanimate instruments through which they work.

Because of these ideals of service, such efforts have sometimes led to the extreme sacrifice. The principals in such acts are truly heroic figures in the drama of life, who modestly effect their accomplishments with conspicuous courage and unselfish devotion to duty. It is these factors of service which make the telephone business more than a utility in its mechanical sense. Telephone employees are participating in rendering a service vital to the age in which we live; a service which, to be the best,

must always include the finer human elements coöperating to maintain the splendid traditions of the business. The products of industry which have only physical qualities become obsolete and wear out; but real service to mankind is as enduring as time. So long as these fundamental facts are acknowledged by society, the Vail Memorial Fund will continue, in the years to come, its important purpose in giving permanent recognition to such outstanding acts of "noteworthy public service."

# ANOTHER WAR GAME TEST OF BELL SYSTEM SERVICES

## *Effective Civilian Aircraft Warning Service Operated by Telephone in Five States, and Prompt Provision of Communication Facilities to Meet Military Needs, Aid Largest U. S. Army Maneuvers*

By CLARENCE S. BOLEN

*The part which telephone services played in the joint exercises of the U. S. Army Air Corps and Anti-Aircraft Artillery held in eastern North Carolina in October, 1938, and more particularly in the operation of the first "Civilian Aircraft Warning Service" during that period, was described in the* QUARTERLY *for January, 1939, in an article entitled "A War Game Test of Telephone Service." The present article bears a closely similar title because, although the Army activities which it recounts were on a vastly greater scale, communications had a correspondingly important part in those maneuvers. Our readers will be interested, we feel, in this second account of the telephone industry's full coöperation with the field forces of the U. S. Army.*

EXTENSIVE activities of the United States Army, culminating in the largest peacetime maneuver ever held, provided the telephone companies along the Gulf of Mexico with an opportunity, during the period beginning May 5 and ending May 25, 1940, to demonstrate the efficiency of commercial telephone service in serving national defense needs.

Seventy thousand seasoned officers and soldiers, or about one-fourth of the total regular army, participated. Eastern Texas, the four southern congressional districts of Arkansas, the states of Louisiana, Mississippi, Alabama, western Florida and western Georgia were included in the territory covered by the make-believe war.

Featuring the military exercises, from the communications standpoint, was the preparation and operation of an "Aircraft Warning Service" in which civilian observers used long distance telephone service to report to a central point group flights of aircraft.

To the Army, the maneuvers were valuable in testing the organization of the new "streamlined" or "triangular" division in comparison with the old "square" division which was used during the World War; in testing the civilian aircraft warning network; in observing the use of horse cavalry in coöperation with and in action against mechanized forces; and in studying the problems connected with the use of large motorized masses and tank masses. The military forces in the

maneuvers comprised the Third Army, commanded by Lieutenant General Stanley D. Embick, who was the Director of the exercises. Units of the Third Army came from their stations in 33 states to participate.

Two army Corps make up the Third Army: the Ninth and the Fourth Army Corps. Each of these held its own corps maneuver prior to meeting in mock warfare in the Sabine and Red River valleys.

Prior to their concentration, these units underwent intensive training during last winter and early Spring. Units of the Ninth Corps then concentrated in the area between the Neches River and the Sabine River, the latter being the boundary between Texas and Louisiana. This Corps, known as the "Red" army for the main maneuver, consisted of 30,000 men under command of Major General Walter Krueger, with temporary headquarters at Nacogdoches, Texas. The Ninth Corps maneuver was carried on from April 27 to May 7. The Fourth Corps, of 40,000 men, was known as the "Blue" army in the war game, and is commanded by Major General Walter C. Short. Concentration of this Corps was at Fort Benning, Georgia. It held a corps maneuver prior to May 5, when it began an overland trek to Camp Beauregard, near Alexandria, Louisiana.

Neither Corps maneuver of these two "enemy" forces involved noteworthy demand upon the telephone system other than increased volumes of local and long distance telephone calls and a demand for more facilities at such points as Ft. Benning and Nacogdoches, all of which were handled in routine fashion.

A new and more interesting phase of the war games, to both Army and telephone men, began May 5, when the Blue army, hearing that the Reds were becoming bellicose, began a 600-mile march to Camp Beauregard.

This movement was made in motorized columns of roughly 10,000 men, moving forward half of each day before camping. Two routes were employed, to reduce interference with regular highway traffic, the northern one passing through Jackson, Miss., and the southern through New Orleans. Temporary telephone service was usually furnished at each camp if sufficient telephones were not already available.

During this march, Red army aircraft attempted to destroy the Blue army columns by direct attack, and harassed it by bombing bridges and other strategic points. To notify Blue aviation forces of their forays, the "Aircraft Warning Service" was established and operated May 7 through May 11.

### *The Civilian Aircraft Warning Service*

THE extent of the Third Army Aircraft Warning Service was the greatest of any such system yet organized. It covered 234 counties, including 17 in southern Arkansas, 11 in Western Florida, and all of the 57 counties (parishes) in Louisiana, the 82 in Mississippi and the 67 in Alabama.

This area was divided into 16-mile squares, an arbitrary military grid, totalling 1600 squares. In each of these squares a subdivision was made

CONTROL SECTION AT CAMP BEAUREGARD, LA.

*Note the "hang-up" hand telephones, with visual signals instead of bells*

into 8-mile quadrangles, with a civilian observation post located as near the center of the quadrangle as possible. With alternates, some ten thousand volunteer civilian observers were engaged in watching for airplanes.

Securing these civilian observers was a task which the American Legion handled in excellent style. Through the Department Commanders and the District Commanders, county chiefs were selected, and they in turn chose the observers. Many of the observers, incidentally, were women.

American Legion representatives, usually the county chiefs, had the full coöperation of the telephone company managers in selecting telephones at existing locations for use as observation posts. This coöperation included the Southwestern Bell Telephone Company representatives in Arkansas, the Southern Bell people in the remaining states, and the many independent telephone company representatives throughout the entire Warning Area.

One of the benefits of the warning network was the experience given civilians in watching for and reporting plane flights, while their enthusiasm in devoting their time to this activity brought satisfaction to army

TYPING THE ARMY'S MESSAGES BY WIRE

*Teletypewriters and circuits were furnished by the Southern Bell Telephone and Telegraph Company; the operators shown here were provided by the Western Union Telegraph Co.*

executive officers. The United States Coast Guard assisted in the network by operating inshore patrol vessels, and by operating observer posts at or near their Shore Stations. At some more inaccessible points, federal and state forestry employes acted as observers.

IDENTIFICATION of observation posts was effected by giving each post a combination of a number and a name. The names ran vertically, for each 16-mile layer on the master map of the Warning Area, while the numbers ran across. The point of origin was the southwest, or lower left, corner of the map. A section of the Master Map was furnished each observation post, showing its identification. A Master Map, showing the available telephone central offices, was prepared by Southern Bell and supplied to each District Chief of the observer network. Observers were then instructed as to the method of reporting airplane flights, and furnished blank forms for recording their observations.

An observer, on seeing two or more airplanes, called for the long distance operator, said *"flash,"* and gave the number of the calling telephone. The operator then connected the observer with the Information Center at Maxwell Field in Montgomery, Alabama, where the information from the entire Warning Area was received. All long distance *"flash"* messages were han-

dled on a station-to-station basis, and, by pre-arrangement with the Army, automatically accepted by operators as "collect" calls.

The traffic department of Southern Bell was in charge of instructing operators in handling these flash messages. This was covered in brief instruction memoranda to "A" operators, farmers' exchanges, tributary offices, originating toll centers, intermediate toll centers, and the inward toll operators in Montgomery.

Maxwell Field in Montgomery was supplied with ten toll terminals, equipped with visual signals instead of bells. The lights remained on until the army operator answered. Operators were enlisted men from the 51st Signal Battalion, Fort Monmouth, New Jersey.

A preliminary test of the warning network was made May 2. Part of the observers were given test messages, and these were put through and then checked for accuracy by comparing the Maxwell Field operator's recording of each call with the original. This developed the fact that the New Jersey men did not always understand the soft Cajun dialect of the bayous, or the equally soft accents of the cotton belt natives. Experience, however, eliminated this difficulty.

THE reports of aircraft in formation received at the Information Center at Maxwell Field from observers were evaluated by Army experts, who then

TELETYPEWRITER ON WHEELS

*A Signal Corps sergeant operating a Bell System teletypewriter in an Army truck at the air field base of the Red army at Lufkin, Tex. The instrument is shown as it receives a message from the Red army general headquarters at Jasper, Tex.*

notified friendly air bases by telephone, teletypewriter, or on the Army radio, so that proper defensive steps could be taken.

Operation of the Aircraft Warning Service was on Central Standard Time, and covered the following periods, beginning Tuesday, May 7:

May 7—8:30 A.M. to 2:30 P.M.
May 8—8:30 A.M. to 2:30 P.M.
May 9—7:00 A.M. to 10:00 A.M., and 3:00 P.M. to 6:00 P.M.
May 10—7:00 A.M. to 10:00 A.M., and 2:00 P.M. to 5:00 P.M.
May 11—5:00 A.M. to 8:00 A.M., and 1:00 P.M. to 4:00 P.M.

Operation of the Aircraft Warning Service caused no delays in the handling of the Company's normal long distance service, since the number of "flash" calls was relatively small, as shown by the following figures:

| State | Messages | Av. Length of Conversation | Speed of Service |
|---|---|---|---|
| Alabama | 393 | 91 Sec. | 42 Sec. |
| Arkansas | 26 | 114 Sec. | 56 Sec. |
| Florida | 87 | 122 Sec. | 62 Sec. |
| Louisiana | 512 | 80 Sec. | 57 Sec. |
| Mississippi | 451 | 81 Sec. | 33 Sec. |

This was a total of 1,469 calls for the five days, or about ten an hour per state for a six-hour period. The average length of these conversations was 86 seconds, and the average speed

RECEIVING THE "FLASH" MESSAGES

*Army operators are recording reports of airplanes seen by civilians who formed the "Aircraft Warning Service." Col. Robert W. Collins, C.A.C. (left), in command of this volunteer service, and Mr. E. T. Harris, District Manager for the Southern Bell Company at Montgomery, are observing operations*

PLOTTING THE REPORTS

*Reports from civilian observers, plotted as they come in, indicate the direction of both invading and defending planes*

of establishing connections by long distance operators was 46 seconds.

Opinions of observers and Army officers were favorable regarding the operation of the telephone network. Here, for example, is a letter from the County Chief at Brookhaven, Miss.:

"As County Chief of the air warning service for Lincoln County, I want to thank you and your excellent force for the splendid coöperation and efficient service rendered us during the period May 7 to 11. All of our posts report that your operators were very diligent and courteous in the handling of all *flash* messages they had during this maneuver."

One of the Army bulletins stated:

"The Southern Bell Telephone Company accepted the responsibility of coordinating the activities of its affiliated companies and all independent companies located within the Warning Service Area. The officials of the Southern Bell Telephone Company have worked untiringly in their efforts to provide the best communication system obtainable. Their coöperation has been outstanding.

"The managers of the local telephone exchanges throughout the entire area have contributed their time and technical knowledge toward assisting County Chiefs, observers and the Army in selecting telephones which would be most suitable for the service. All have generously devoted their energies toward providing the best communication system possible. The coöperative interest which has been displayed by all telephone officials has contributed to a

CONTROLLING THE MAP LIGHTS

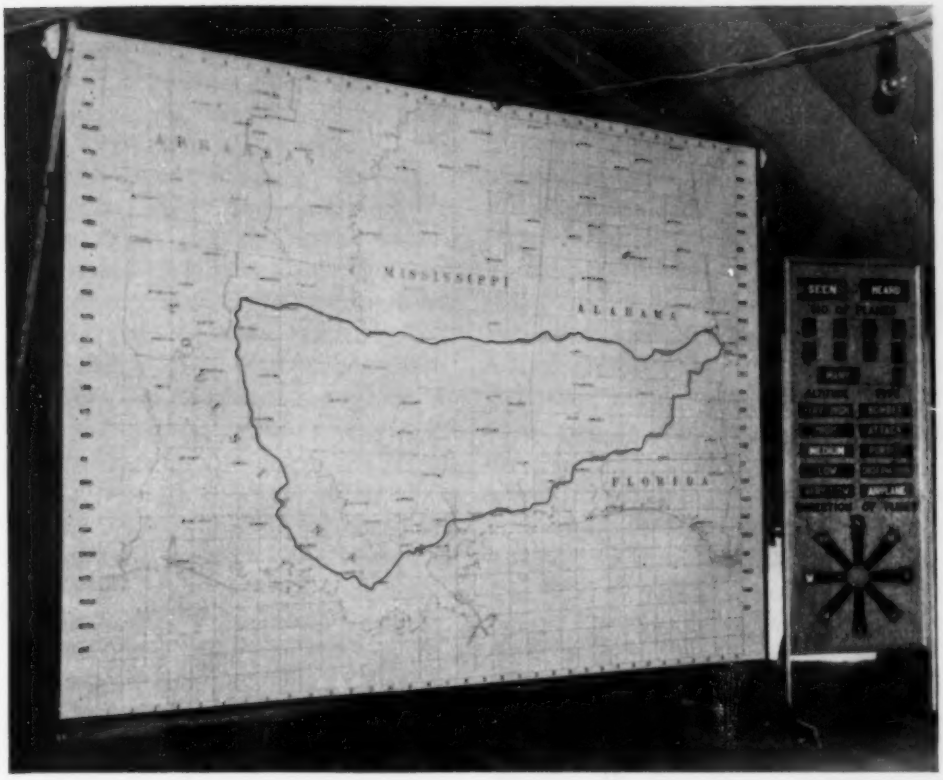
*These switchboards control electric lights on the large maps and descriptive panels in the visitors' assembly tent—shown on the opposite page—and the flight evaluation room*

great extent to the development of the organization as it stands today."

### *Use of Toll Credit Cards*

SUCCESSFUL use of regular Bell System "Toll Credit Cards" was an innovation with the Third Army Maneuvers. During such an extensive series of military operations, Army officers necessarily have to make use of commercial long distance telephone facilities from various points. Army Regulations make no provision for reimbursement for such expenditures, and "collect" calls are not always practicable.

Southern Bell therefore suggested the use of the credit cards, and the suggestion was adopted. About 400 such cards were issued in blank to the Corps Area Signal Officer at Ft. McPherson, Ga., who reissued the cards to individual officers who were to act as umpires, control officers, or on tactical and administrative units. As the cards were issued, the Signal Officer furnished the telephone company with the information regarding each card, for use of the various departments. All Bell and independent company traffic forces in the Maneuver territory were instructed on the




THEATER OF OPERATIONS

*On this map of the maneuver territory, each of the small blocks, 16 miles square, contains four posts of the "Aircraft Warning Service," each represented by a light. Successive reports result in a row of lights which shows graphically the line of flight of planes. The heavy irregular black lines trace the separate routes followed by the Blue forces from Fort Benning, Ga., to Camp Beauregard, La.*

handling of calls made with the credit cards. The cards were returned to the Signal Officer at the conclusion of the Maneuvers, for cancellation. While considerable use of the cards was made during the Corps maneuvers at Ft. Benning, and on the march to Louisiana, most of the use came during the "battle" of the Sabine Valley.

Cards for the Red army were issued by the Southwestern Bell Telephone Company, handled through the Signal Officer of the Ninth Army at San Antonio, Texas.

Blue army officers placed 4,719 long distance telephone calls with their credit cards during the Maneuvers.

IN addition to local and long distance telephonic communication, the Maneuvers were served by private lines and other special services. The local circuits from Alexandria to Camp Beauregard were increased,

while ten trunks were added from Columbus, Ga., out to Ft. Benning. At Montgomery, five extra trunks were supplied during the Aircraft Warning Service operations.

Practically all of the special services furnished by Southern Bell were located in Louisiana. Four teletypewriter channels with #15 machines, and four such channels without machines, were provided. Army switchboards were connected with full-period talking circuits between Leesville and Florien, Many and Florien, and from Leesville to DeRidder. Full-period talking circuits were furnished from Camp Beauregard to Dry Prong, Leesville and Barksdale Field at Shreveport, the latter having a drop at the Natchitoches airport.

Teletypewriter service, using #15 machines, was provided by the American Telephone and Telegraph Company between Maxwell Field at Montgomery, Ala., and the airport at McComb, Miss., on a full period basis, May 1.

### *The Red Army Maneuvers*

As the maneuvers of the Ninth Corps Red army took place chiefly in East Texas in an area served by the Southwestern Bell Telephone Company, its commercial communication requirements were furnished by that company.

The main line circuit layout, forming the Red communication network, was a circular arrangement of talking and teletypewriter circuits extending to army depots, supply bases, etc., in Nacogdoches, Lufkin, Beaumont, Jasper, and San Augustine, Texas. These permanent establishments were connected to moving field headquarters by army extension lines which could be "tapped" to the permanent circuits at several points. All told, eight full talking circuits, totalling 829 miles, were used by the Ninth Corps Red army and leased jointly from the Southern Bell Company and the Southwestern Bell.

The Army also leased, through Southwestern Bell, 582 airline miles of teletypewriter circuits in Texas and Louisiana. Neither of the above includes services for the Fourth Army Corps or the Third Army handled by the Southern Bell Company, except commonly used umpire and referee channels.

Close coördination was maintained with Signal Corps officers throughout the maneuvers, and the experience gained during these military exercises was valuable in demonstrating the ability of Bell System equipment and services to meet the demands made upon them under field conditions.

Equipment and services furnished by the Southwestern Bell Company included 20 business telephones, five service line business telephones, and two PBX trunks at Beaumont, Jasper, Nacogdoches, and San Augustine, Tex.; 35 private telephone lines at Jasper, Kirbyville, and San Augustine, Tex.; 21 #19 and five #15 teletypewriter installations in Texas and four teletypewriter channels in Louisiana; three foreign exchange lines and one private line in Texas and two private lines in Louisiana.

Two emergency portable radio telephone sets were also held available, and were used experimentally.

In addition, Southwestern Bell placed 20 circuit miles of wire between Jasper and a point near Horton, Texas, on an existing toll pole line. Army wire and telephone company labor were used.

On another work order, the telephone company placed, on a contract basis, 1509 poles to connect Army telephone and teletypewriter facilities between Jasper, Texas, and Leesville, Louisiana; also from San Augustine, Texas, to the Sabine River. Wire on these leads was strung by Army personnel.

In a radio broadcast on May 4, Major W. O. Reeder, Signal Officer of the Ninth Army Corps, reviewed the communications needs of the Army and the work of the Signal Corps. His broadcast was carried over Radio Stations WFAA, Dallas; KPRC, Houston; and WOAI, San Antonio. Major Reeder concluded his talk with the following statement:

> "It would be sheer ingratitude to close this brief talk without paying a sincere tribute to the patriotic coöperation of the Southwestern Bell Telephone Company, whose officers have assisted so ably in the planning of the Ninth Corps' communication system and whose employees are bending every effort to see that their part of the maneuver communications system does not fail."

THE conclusion of the Maneuvers came May 25, after which the units of the Ninth and Fourth Army Corps went back to their respective posts for further training during the summer. The setting for their "battle" at Camp Beauregard, according to present plans, will be the scene of another giant maneuver of National Guard troops during the summer, so part of the communication facilities may be left in place.

Various critiques of the maneuvers discussed the relative value of radio and telephone land line communications. Radio, obviously, must be used for reaching airplanes, and often is useful in making contact with mobile units. However, the lessons of Europe's war seem to indicate that wire communications are the mainstay.

Regardless of these considerations, Army officers generally were generous in their commendation of the telephone service, and of the folks who furnished it to them, during the "Battle of the Bayous" in the Sabine valley.

The author wishes to acknowledge the assistance of Mr. Frank Witten, advertising manager for Texas of the Southwestern Bell Telephone Company, in the preparation of the material covering activities in that company's territory.

# CONVENTIONS AND COMMUNICATIONS

## *These Quadrennial Political Events Create a Week's Peak Demand for a Variety of Bell System Services Which Is Met Successfully through Planning, Co-ordination—and Quick Work*

By PETER L. SCHAUBLE

*Due to the exigencies of publication schedule, the following account can deal only with the national convention held in Philadelphia in June; but it may be taken as generally descriptive also of the equipment and services provided at the convention in Chicago, which took place after this issue of the* QUARTERLY *had gone to press.*

DURING the Republican national convention of 1896—according to a newspaper dispatch of the time—William McKinley, at his home in Canton, O., was in touch by telephone with the convention hall in St. Louis, Mo. Sixteen years earlier, and therefore only four years after the invention of the telephone, there had been—also according to a contemporary newspaper item—a local call to a member of a convention committee a few days before the convention of 1880 in Chicago. Thus for at least sixty years the telephone has played a part in the political life, as in every other aspect of life, of the American people.

Particularly during the last two decades has the development of electrical communication brought to citizens from coast to coast increasingly full and speedy accounts of the proceedings by which the two major parties select their candidates for the highest elective office in the land. The provisions which the Bell System has made to facilitate the business, and to aid in the dissemination of news of every act, of these quadrennial dramas have twice before been described in these pages.*

This convention year the telephone, telegraph, radio, teletypewriter, telephotography, the press and—for the first time—television combined to keep Mr. and Mrs. America, back home, virtually as well informed about what was taking place at the convention as their duly elected delegates who were actually participating in the ever-changing scene. In the parlance of the news room, it was "coverage" to a degree never before attained. Inextricably woven into this gigantic network of electrical communication were the many serv-

* "Communications and the National Conventions," by G. K. McCorkle, QUARTERLY, July, 1932; "All America at the Conventions," by G. G. Breed, QUARTERLY, July, 1936.

NEWS IN THE MAKING

*A corner of the press stand during the convention*

ices which the Bell System has developed, and furnishes to meet the widely varying needs of its customers.

### *Responsibilities of the Job*

IT is a fundamental aim of the Bell System to provide a service so complete that practically any one, anywhere, can talk by telephone with any one else, anywhere in the country. At times during the progress of a national political convention, it would seem to a casual observer that everybody in the convention city was trying to accomplish that very thing.

The job of providing service for a convention is no overnight, ordinary run of the mill assignment for the local telephone company and the Long Lines Department of the A. T. & T. Co. It is doubtful if any other recurring event of national importance closely approximates the communication requirements of such an assembly, whose deliberations at a critical moment may swiftly change as the result of a telephone call across the street or to a far-away state.

It is on such occasions that communication agencies readily assume increased responsibilities, and the task of providing high-grade, dependable facilities takes on added significance. There must be no unforeseen obstacles to delay or interrupt the swift dissemination of information to the waiting public, whether it be in the form of pictures transmitted by wire, messages over telephone lines, or a radio broadcast. It is under such circumstances that complete coördination of effort, as exemplified by the nation-wide organization of the Bell System, becomes increasingly important.

TELEVISION MONITOR

*An engineer of the Bell Telephone Laboratories guards the television program as the signals leave Convention Hall for transmission over telephone wires to the coaxial cable in downtown Philadelphia*

Each succeeding convention has its own peculiarities and new problems. No two are precisely alike. And, in passing, it is not unimportant to note that the conventions of 1940 surpassed all others in demands upon the communications industry.

Improvements in the telephone art, supplemented by a highly skillful and trained organization, made it possible to meet these unprecedented demands with promptness and dispatch. As one man, the telephone forces tackled the job and saw it through to the finish.

Careful planning is the first essential element in providing the necessary telephone service for a political convention. Weeks before the opening session, telephone groups began to lay their plans. Slowly the job gathered momentum, and reached a peak of activity when the delegations and thousands of guests from the states rolled into the host city by rail, plane, and motor, and swarmed into hotels assigned to them by convention officials.

The convention, to all intent and purpose, was then on; and no respite from the sustained stress was in prospect for telephone men and women until a week later, when the city once again resumed the even tenor of its ways.

LET us take a look as what is going on in Philadelphia's Convention Hall.

TELEVISION PREVIEW

*Miss Mary E. Martin, assistant chairman of the convention, is interviewed before the television camera on the sidewalk in front of convention hall prior to the opening of the convention. At the right is the image as seen by "televiewers" after transmittal to NBC's New York studio*

The Chairman steps to the rostrum, calls the convention to order. His every word is picked up by microphones of the broadcasting companies and flashed to millions listening at their receiving sets.

Operating from specially devised booths far above the floor of the convention, the broadcasting companies' ingeniously devised and strategically located facilities permit, by the mere turning of control switches, the picking up of speeches by delegates, state by state announcement of the balloting, interspersed at intervals by interviews with candidates at their hotels in downtown Philadelphia and by the colorful comments of radio commentators.

Flanking the platform on either side are row after row of newspaper men and women, their pencils and typewriters putting on paper pulsing word descriptions of the proceedings which are transmitted instantly by scores of nearby teletypewriter and Morse key operators to the newspapers throughout the land. In a few brief minutes people on the streets of New York, Chicago, San Francisco and many other cities will read these detailed accounts of events unfolding

*A Bell System Plant man (right) checking up on a teletypewriter. Machines such as these are used by the great press associations*

at the Convention, so swift are the agencies of communication.

### *The Newcomer: Television*

AH, here is something to arrest your attention! As you look about the great hall, your eye catches a glimpse of two odd-looking contrivances on an improvised platform extending from the first balcony. "Television cameras," some one informs you. Then a National Broadcasting Company engineer explains that NBC, with the coöperation of the Bell Telephone Laboratories, is televising the convention.

Four television cameras are employed at Philadelphia: two are set up to catch the kaleidoscopic scenes in Convention Hall, a third is located in a special studio for interview purposes, and the fourth is utilized to televise party chieftains and others as they arrive at the Hall.

At certain hours during the day and evening the programs are transmitted over telephone wires from Convention Hall to the long distance telephone building in downtown Philadelphia, and thence over the experimental coaxial cable to New York, where they are "telecast" by Station W2XBS in Manhattan. It is the first time the coaxial cable has been used to transmit television signals to be broadcast to the public.

This cable, manufactured by Western Electric Company, has been equipped by the Bell Telephone Laboratories for transmitting television signals, including those used at present by the National Broadcasting Company. This has required the provision of amplifiers at 5-mile intervals that will transmit frequencies up to about three million cycles, and equalizers that will maintain proper strength of all the frequencies within this very wide band as well as equal times of arrival within a small fraction of a millionth of a second.

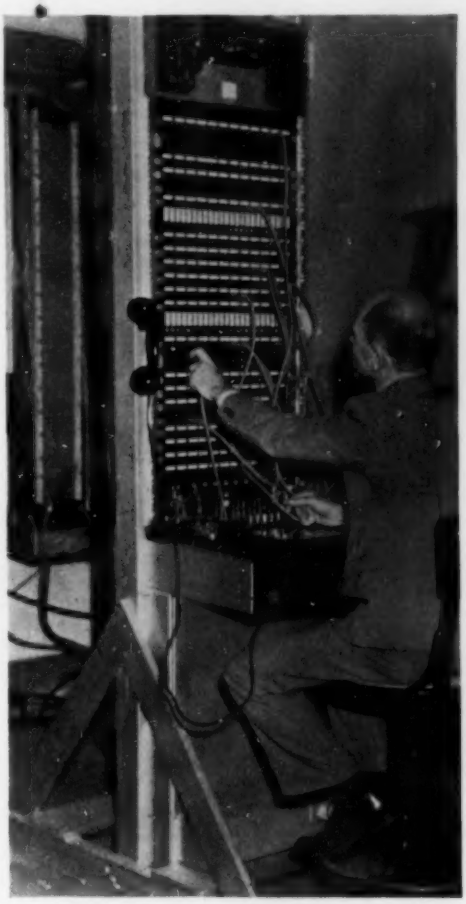
Besides equipping the coaxial cable, it has been necessary to arrange for transmission between Convention Hall and the long distance telephone building in Philadelphia, and between the Laboratories and Radio City in New York. For these shorter distances, it is possible to use regular cable pairs, as was done for recent television transmission from Madison Square Garden and Radio City. Such circuits do not transmit television signals as readily as does the coaxial cable, and amplifiers are needed at approximately one-mile intervals.

These amplifiers are provided with suitable "equalizers" and are located and installed with special precautions to avoid "noise" disturbances. In New York City a new type of cable, employing shielded pairs of wires, has also been installed to link the Bell Laboratories with Radio City. This new cable has the advantage of requiring no intermediate amplifiers for the distance involved.

For the cable runs at each end of the coaxial cable, it is simplest to transmit the signals just as received from the television camera, the so-called video signals, extending from a few cycles per second up to several million. For most satisfactory transmission over the long length of coaxial cable, however, special equipment is provided at Philadelphia to shift the frequency band upward by about 300,000 cycles. Corresponding equipment is provided at the Laboratories to bring the signals back to the video range.

The quality of the results obtained was so satisfactory—to lapse for a moment into the past tense—that the experiment proved eminently worth while from the standpoint not only of the Bell Telephone Laboratories and the NBC but from that of the public as well. It is estimated that as many as 50,000 persons in and around New York at times looked in on the convention via this modern miracle of television.

Proceeding around mammoth Convention Hall, in one of the corridors you come across a specially-installed battery of telephones with pages standing nearby. These telephones are connected to the headquarters of the various candidates in downtown hotels and enable them to communicate promptly with delegates while the convention is in session.



*The Long Lines Department of the A. T. & T. Co. installed this testboard in Convention Hall for the duration of the convention*

At various locations are twelve telephones connected to the private branch exchange serving the National Committee in the Bellevue-Stratford Hotel. Two others, connected to the same switchboard, are on the speakers' platform.

The great hall is adequately equipped with telephones for the con-

venience of the crowds. Supplementing the some half-hundred telephone booths permanently located on the premises is an attended pay-station room with twelve booths, one of which contains a telephone for the use of persons with impaired hearing.

Outside the main entrance to the structure stands an attended pay-station trailer with four booths. Curious throngs inspect this mobile telephone unit; hundreds of others step inside, give their desired numbers to the operator, and from the comfort of air-conditioned booths make important last-minute calls before the convention session gets under way.

Squads of telephone men hurry about the building, installing additional facilities and making necessary changes in the existing wire network to meet the inevitable last-minute requests. Their headquarters are in a temporary Plant office on the first floor. Essential materials are on hand; there is no delay in completing an order. In another room is a temporary Business Office for receiving these urgent requests for service.

### *Providing Adequate Facilities*

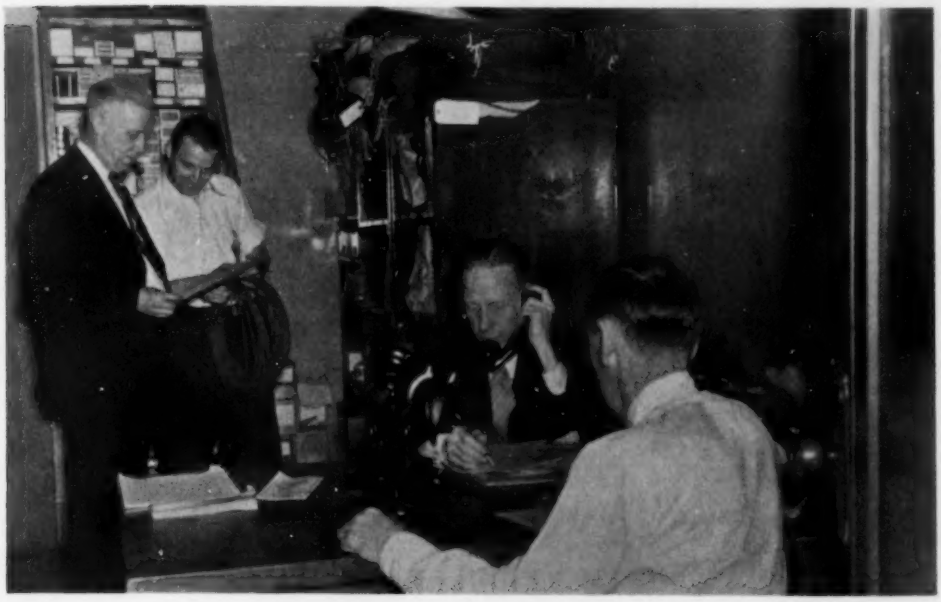
IMPORTANT to the telephone company is the objective that adequate facilities shall be available at all times, wherever and whenever they may be needed by the thousands of delegates and visitors to the convention city. As an added safeguard at Convention Hall, telephone wires entered the building by two different routes, as did they also at the Bellevue-Stratford Hotel.

To insure the public having the best service possible, there was made a thorough inspection of all public telephone facilities and private branch exchanges in the various hotels. All possible changes and additions were completed well ahead of convention week, including the installation of private branch exchanges to serve the candidates, and a three-position board for the use of the National Committee.

However, the entire telephone job cannot be handled in advance. Once the convention opens, there is a continuous flow of requests from all quarters, at all hours. An additional line is wanted here; broadcasting circuits to two hotels are set up late at night so that the successful candidate, hurrying back and forth between them, may speak to the nation; private branch exchange batteries are watched closely, for the power requirements are heavy; emergency charging sets are provided and held in readiness. There is no let-up in the activity.

From a telephone standpoint, one of the busiest spots in Philadelphia was the private branch exchange in the Bellevue-Stratford Hotel—an eight position board which serves 1,000 hotel telephones. To care for the situation here, the operating force was built up to a peak of thirty-one women. Working in tours, they handled traffic loads ranging up to 1200 per cent above normal. Comparable situations existed in the Benjamin Franklin and other big hotels.

Local and long distance telephone traffic ebbed and flowed. During convention week in Philadelphia, long distance calls ran about thirteen per cent above normal. On Friday—the day the convention wound up its balloting with the selection of a Vice



PLANT HEADQUARTERS IN CONVENTION HALL

*The Bell Telephone Company of Pennsylvania provided men and materials to meet quickly the day-to-day needs of the convention*

Presidential nominee—they shot up twenty per cent above normal.

Of material assistance in the expeditious handling of the great volume of calls to and from the delegates and convention officials was a one-page telephone "directory" which listed the many individuals, committees, news associations and other agencies which had subscribed for service during the convention. This information sheet was revised and issued daily to private branch exchanges in hotels, and to newspapers, telegraph companies, and the like. It also was used by the telephone company's own information operators.

IMPOSSIBLE is it to recount here all that was done in a telephone way to let America listen and look in on the dramatic proceedings of a great political convention. It is enough to say that the countless telephone men and women working quietly, efficiently, intently behind the scenes—whether in the midst of the frenzied activity in the convention city or performing a routine test at some remote outpost of the Bell System network—gave generously of their painstaking best and proudly played their part in another historic high-light in the life of the nation they serve.

# SUN SPOTS AND TELEPHONE SERVICE

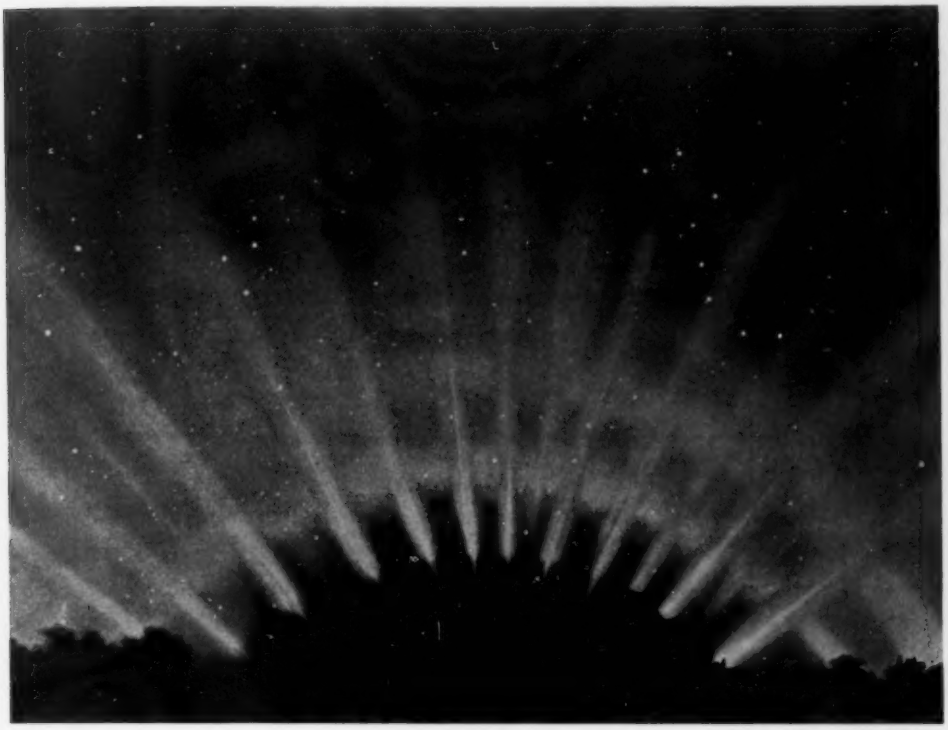
## *Solar Disturbances Which Influence both the Kennelly-Heaviside Layer and Earth Currents Probably Cause Magnetic Storms Like That Which Affected Electrical Communications Last March*

By GLEN IRELAND

In the remote past, our ancestors were undoubtedly disturbed by unusual displays of northern lights, which we now refer to as aurora borealis or polar lights. However, amidst the crude surroundings of centuries ago the presence of these lights probably had no other effect than to awe, or to be considered, along with other celestial phenomena, as portending great events. Later, after the compass came into general use (about the 13th century), mariners may have noticed on occasion some erratic movement of the compass needle, and it is possible that the more scientific minded of the early mariners may have noted a correlation between these movements and the unusual displays of polar lights.

In 1844 the first commercial electromagnetic telegraph system was placed in operation, between Baltimore and Washington, and during the next few years this form of communication spread rapidly both in the United States and in other parts of the world. Soon after these systems, which operated with a single wire and ground return, were placed in operation, there occasionally appeared other signals or interference which sometimes became so frequent and intense as to interfere seriously with transmission of telegrams. It is recorded that a British scientist, W. H. Barlow, after close observation of this interference to the telegraph, concluded in 1847 that the interference came from the earth. Soon thereafter it was recognized that these occasions of severe interference to the telegraph, called earth current storms, were associated with brilliant northern lights in the same manner as was the erratic behavior of compass needles. In 1859 all the grounded telegraph lines in the world were apparently affected by a very severe storm. During most of the seven-day period from August 29 to September 4 of that year, it was impossible to transmit telegrams. On one line in France which spanned a distance of 373 miles the current was said to be "equal to that produced by a battery of 800 volts."

The effects of such storms have gradually become of much greater importance as first the telegraph, then the telephone, and lastly radio have been introduced and become more



HAYDEN PLANETARIUM

A RARE DISPLAY OF THE AURORA BOREALIS

*Showing both arches and streamers, this picture is reproduced from a pastel made more than half a century ago by Etienne Trouvelot (1827–1895), artist and amateur astronomer*

widespread. Due to the presence of these and many other new services, and the dependence which our modern civilization places on them, the great magnetic storm which occurred on Sunday, March 24, 1940, probably had more diverse reactions on communication services than any that have occurred before. It is believed that readers of the QUARTERLY will be interested in a discussion of the causes of such storms and some information about the March 24 storm, particularly as it affected Bell System services.

The underlying cause of the magnetic and electrical disturbances on the earth probably resides in disturbances in solar activity, of which sun spots are perhaps only one manifestation. This has become evident as a result of a great amount of data taken over a long period of years. These data show a correlation between solar activity, as revealed by the sun spots, and the occurrence and intensity of polar lights and electrical and magnetic disturbances on earth. In this connection, Figure 1 shows the annual mean of relative sun spot numbers and the annual mean magnetic activity from 1835 to 1939.* The

* The magnetic activity is measured by an index that depends on the day-to-day change of the mean horizontal intensity of the earth's magnetic field.

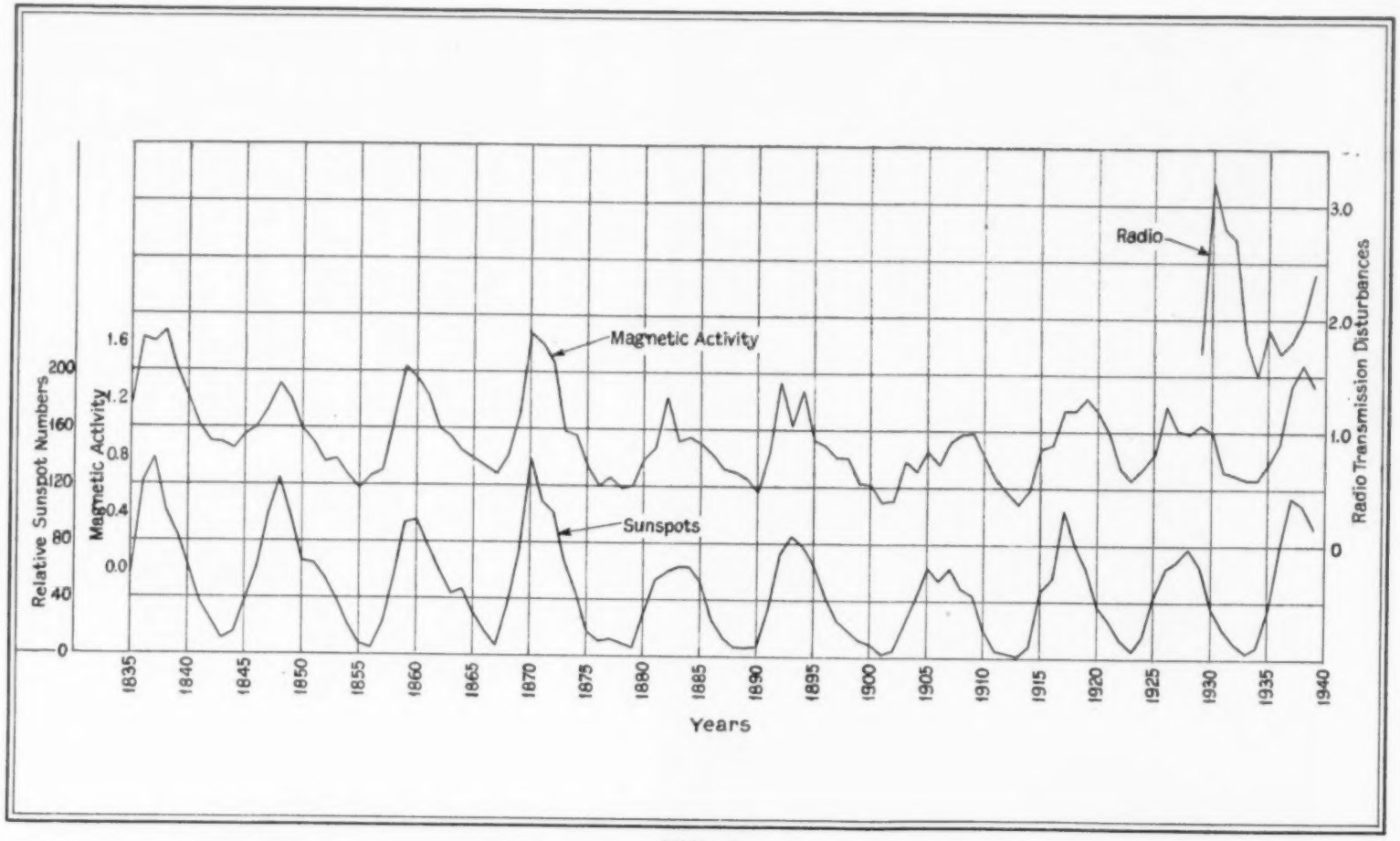



FIG. 1

*Chart showing the annual mean of relative sun spot numbers, of magnetic activity, and of radio "transmission disturbance"*

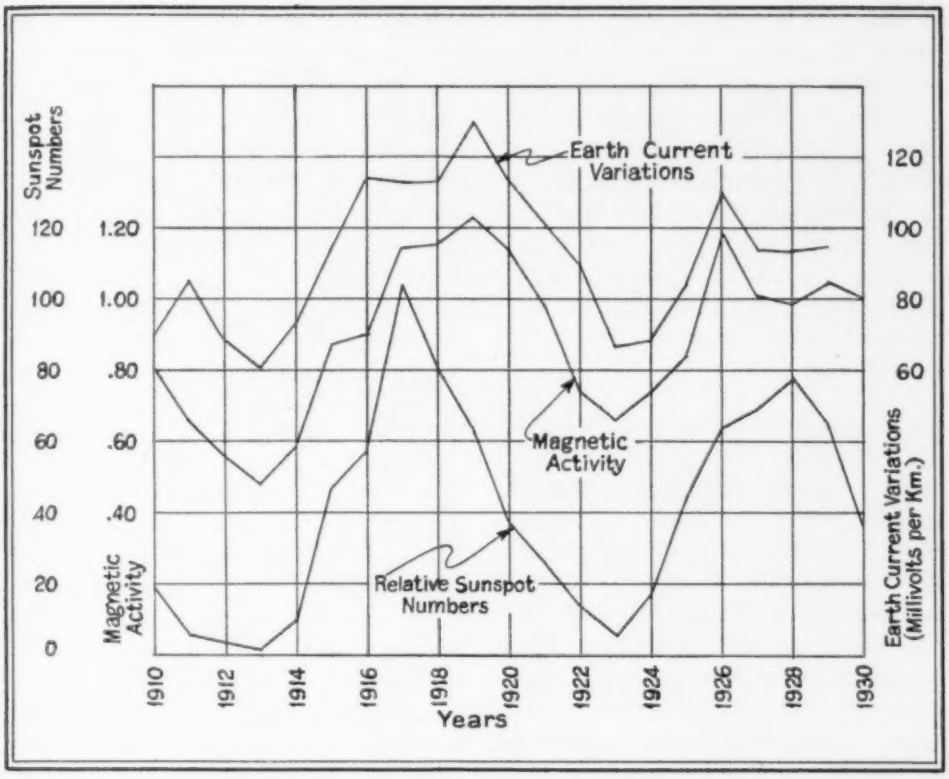



FIG. 2

*Chart showing the annual mean of relative sun spot numbers, of magnetic activity, and of earth current variations* *

relative transmission disturbance over short wave radio channels for the period from 1929 to 1939, inclusive, is likewise shown. The correspondence between the magnetic activity and relative radio disturbances, on the one hand, and the relative sun spot numbers, on the other, is very evident. All show marked maxima at intervals of about 11 years. The question as to why, in the first place, the solar activity should vary in these 11-year cycles is still unanswered. Incidentally, it is interesting to note from Figure 1 that there was a definite peak in magnetic activity in 1859, the year when the severe effects on telegraph circuits previously mentioned were experienced. Figure 2 illustrates the same general relationship between the annual mean sun spot numbers and annual mean magnetic activity, and, in addition, indicates further their relationship to earth current variations. Further evidence of the correlation between solar activity and the presence of polar lights and magnetic and electrical disturbances

* Earth current variations from "The Natural Electric Currents in the Earth's Crust," by O. H. Gish, in *The Scientific Monthly*, January, 1931.

*Chart showing the annual mean of relative sun spot numbers, of magnetic activity, and of radio "transmission disturbance"*

is indicated by the fact that after the initial occurrence of these phenomena, there is a considerable tendency for the polar lights and the disturbances to recur about 27 days later. This is the time required for the sun, at the latitude where sun spots are most prevalent, to make one complete rotation as viewed from the earth. Short wave radio transmission measurements further bear out this 27-day relationship.

IN view of the above information, and of additional data not cited here, there is general agreement that the magnetic and electrical disturbances in the earth's surface and atmosphere are basically due to tremendous disturbances on the sun, which are usually accompanied by sun spots. However, just how these disturbances on the sun create in turn the disturbances on the earth is not a matter of complete agreement among astronomers, physicists, and others interested in the study of solar activity and its effects.

There is considerable evidence to show that the disturbed areas on the sun emit streams of electrically charged corpuscles. A stream of electrically charged corpuscles, on encountering the ionized layer which exists above the surface of the earth (known as the Kennelly-Heaviside layer), greatly affects the state of ionization in this layer, causing a violent boiling or turbulence of the entire ionosphere in the auroral zone. Then, either directly by flow toward the region of the earth's magnetic poles, or indirectly from reactions set up in the ionized layer, large currents are caused to flow in the earth. The theory that the sun's emission is of the nature of electrically charged corpuscles which reach the earth's atmosphere and the earth itself, is supported by photographs of auroral displays in northern latitudes and analyses of their spectrum, as discussed in a previous issue of the QUARTERLY.*

Since the amount of current flowing in earth varies greatly from point to point because of geological differences in the make-up of the earth and variations in resistivity along the earth's surface, the voltages which are present likewise vary, being considerably greater per unit length between some points of the earth's surface than between others. Also, the ground currents and voltages generally tend to become greater in upper latitudes and smaller toward the equator. This may be explained in terms of the theory mentioned previously that the charged corpuscles would tend to flow toward the regions of the earth's magnetic poles and that, accordingly, the current flow would be of greatest density in those regions.

CONSIDERING now the effect on communication circuits, it is evident that short wave radio circuits, which depend for successful transmission on a certain state of ionization of the Kennelly-Heaviside layer, would be greatly affected during periods of solar activity. (Waves from a short wave radio transmitter are propagated into space and, on encountering the Kennelly-Heaviside layer, are reflected back to the earth, to be intercepted by the receiver at the distant

* "The Aurora Borealis," by R. W. King, QUARTERLY, April, 1926.

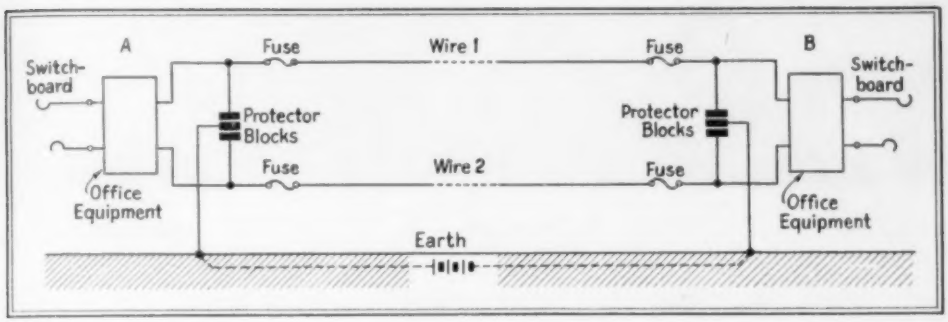
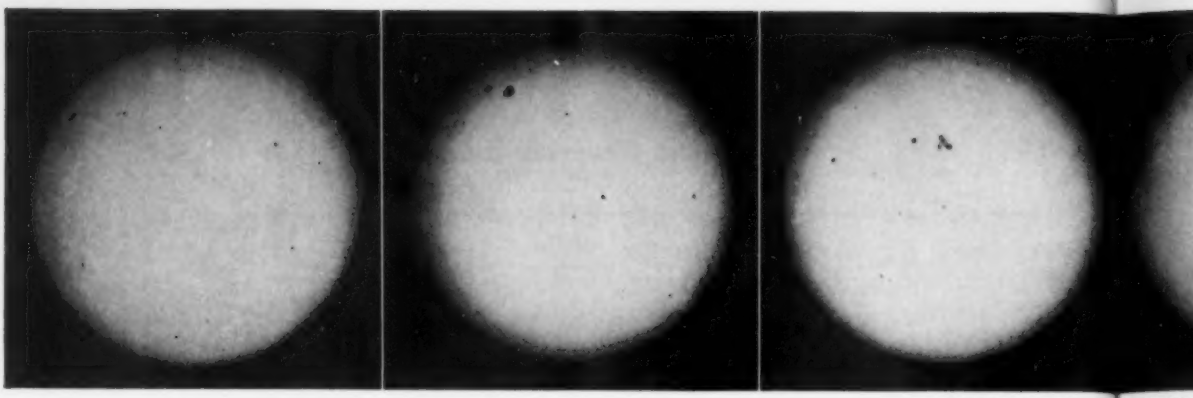



FIG. 3

*Schematic representation of a simple telephone circuit, with protective arrangements and a high earth potential difference*

point of communication.) Also, in the case of grounded communication circuits, which require for successful operation that differences in earth potential between the two ends of the circuit be kept relatively small, such periods of great solar activity and magnetic disturbances are likely to cause some reactions. A circuit operating on a metallic basis, for example, on a pair of wires, is not affected unless the difference in ground potential between the two ends of the circuit exceeds the insulation strength of the circuit to ground. The breakdown of the insulation to ground would render the circuit unserviceable. In some cases this would result in permanent damage unless the circuit were equipped with protective apparatus such as carbon block protectors, which are designed to have a lower strength to ground than the circuit to be protected. The way in which these protectors act is described in the following paragraph.

Figure 3 shows the diagram of a telephone circuit operating on a metallic basis between points A and B and with carbon block protectors at each end. If a voltage is built up on the wires, due either to lightning or the presence of some other source of foreign potential, it breaks across the small gap between the carbon blocks and escapes to ground. Such high potentials are thus diverted from the central office equipment. A peak voltage of about 450 volts between line wires and ground is required, on the average, to break down the protectors in this manner (minimum of about 350, maximum of about 575 volts). When high earth potentials exist, the protector blocks operate in a reverse manner. In this case a high potential between points A and B, which may be represented by a battery connected between the two grounded blocks as shown in Figure 3, will break across to the blocks connected to the line wires. Depending upon the particular circuit terminating conditions, the breakdown of gaps due to ground potential requires on the average about 450 volts and in many cases as much as 750 volts, particularly when two sets of protector blocks are in series.




*March 21* *March 22* *March 25*

FIG. 4

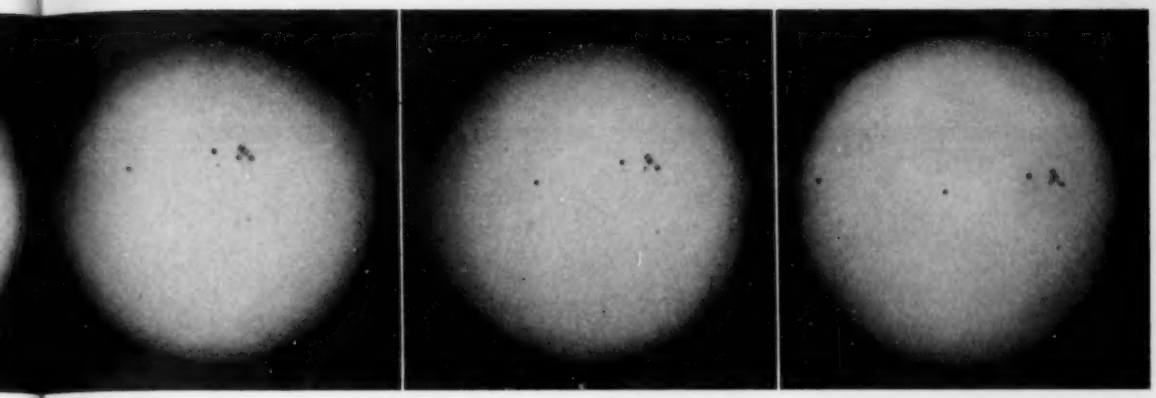
*Sun spots: Photographs of the solar disc on six days last March*

### *What Happened on March 24*

BUT now, let us return to a consideration of what occurred on March 24. Magnetic records made at the United States Coast and Geodetic Observatory at Cheltenham, Maryland, show that the storm began at 8:50 A.M. (Eastern Standard Time) March 24. At 10:45 A.M. an unusually violent period began, reaching its maximum about 12:00 noon and continuing until about 2:00 P.M. A high degree of magnetic activity persisted until about 9:00 A.M. on March 25. Unusual displays of aurora borealis were seen on the night of March 24, being visible as far south as Tucson, Arizona. A moderately large group of sun spots was present on the central disc of the sun during the storm. This can be seen from Figure 4, which is a succession of photographs taken of the solar disc on days just before and just after the period of greatest disturbance. Reports from various observatories throughout the world indicate that, considering both intensity and duration, the storm of March 24 will probably be remembered as one of the greatest of magnetic disturbances.

With respect to land line communications, it is interesting to note that the times when reactions started, when the maximum reactions occurred, and when, in general, they ceased, corresponded closely with the indications of the magnetic records of the observatory at Cheltenham. The earliest report of trouble on land lines came at about 9:00 A.M., E.S.T. By 10:00 to 10:30, E.S.T., reports of trouble were indicated from widely separated points in Ontario, Canada, Connecticut, Minnesota, and on the Pacific Coast. Generally, the troubles throughout the country reached the peak from about 11:30 A.M. to 3:00 P.M., E.S.T. Relatively few troubles were encountered after about 4:00 P.M., E.S.T., March 24. Most of these troubles involved the operation of protective equipment, which opened or grounded the circuits. Some reactions on land line services were reported in the United States in all except a few southern states. Similar reactions were reported from a number of points in Canada. A few cases of operation of carbon block protectors were noted, especially in Minnesota, in the morning hours of March 25.

Figure 5 indicates by small dots the points at which circuits of the A. T. & T. Long Lines Department were



ASHINGTON, D. C.

*March 26* *March 27* *March 28*

affected. The shaded portions represent areas in which, from a consideration of the geological structure of the earth, high earth resistivity would be expected to exist. This has been verified to some extent by actual measurement. As shown on Figure 5, almost the entire state of Minnesota falls in a high resistivity zone. Figure 6 is a map of Minnesota with dots representing points at which circuits of the Long Lines Department, the Northwestern Bell Telephone Company, the Tri-State Telephone and Telegraph Company, and connecting companies were affected by high earth potential differences.

In general, it was difficult to determine the maximum voltage experienced, since in some cases where measurements were attempted the protective apparatus operated and grounded the circuits involved. However, from at least one point (the Boston toll test room, as shown in the record for March 24—on page 193) have come indications that voltages in excess of 600 volts and probably as high as 800 volts negative and changing to 400 volts positive were experienced between two points about 75 miles apart.

Protector operation was reported on several circuits only 20 to 25 miles in length, indicating in these cases ground potential differences of at least 350 volts over these short distances. In general, throughout the sections of the country affected, the voltages fluctuated from positive to negative with intervals ranging from seconds to minutes.

For about two years the ground potential difference between Minneapolis, Minnesota, and Fargo, North Dakota, has been continuously recorded by an automatic recording system. The two portions of the chart from this system shown in Figures 7 and 8 rather completely illustrate the previous discussion. Figure 7 shows the potential difference to be near zero and varying relatively little until just before 9 A.M., E.S.T., on March 24, 1940 (the chart itself records Central Standard Time). At this time wide swings of the needle began and soon thereafter, as indicated by the zero recording near the end of the chart, the system went out of service due to operation of fuses and carbon block protectors and to subsequent testing activities on the circuit.

This recording system is grounded at Fargo and is equipped with carbon

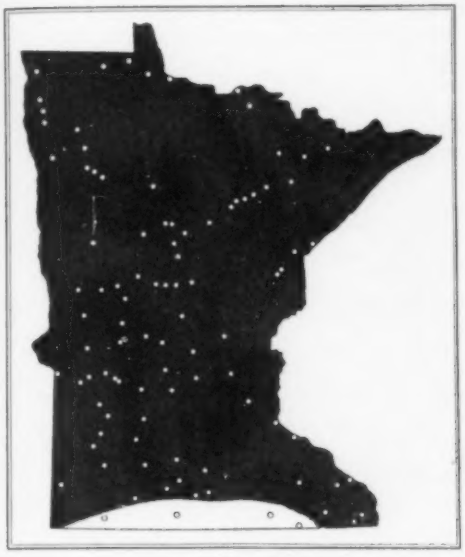


FIG. 6

*A map of Minnesota similar to that opposite, the dots indicating where circuits of various telephone companies were affected by high earth potential differences*

block protectors, so that it would be expected to go out of service, on the average, when the potential difference became as high as about 400 to 500 volts. The system would not, therefore, record the greatest potential differences encountered. While the severest effects of the storm occurred on March 24, the portion of chart in Figure 8 shows that on the morning of March 25, considerable potential differences were still occurring and were varying rapidly between positive and negative values. The carbon block protectors operated at about 5:15 A.M., E.S.T., at which time potential differences in the order of 400 volts were being recorded.

Nearly all overseas radiotelephone circuits and service to ships at sea were greatly affected. The short

### *Observations at Boston Toll Test Room*

**New England Tel. & Tel. Co.**
***March 24, 1940***

9:30 A.M. Meter in grounded Keene line shows potential of 75 to 100 volts negative.

10:00 A.M. Put recording voltmeter on Keene line. Meter goes off scale (125 volt scale).

11:00 A.M. Put two 150 volt meters in series on Keene line. Both meters go off scale (over 300 volts).

11:30 A.M. Put 3 meters in series on Keene line. Potential varies from about 300 volts positive to 400 volts negative and goes off scale negative (over 450 volts). Put in 4th meter in series and watch.

11:35 A.M. About this time voltage creeps up to near 600 and finally goes off scale negative (over 600 volts). Needles stayed off scale for a period of about 4 to 5 seconds, then returned to about 300 volts. At this point 11 of the No. 74 type heater fuses let go on the Morse Battery panel.

The variation in ground potential as measured between Boston and Keene, and which started around 9 A.M., was very erratic, sometimes reaching as much as 400 volts positive and over 600 volts negative, which occurred around 11:30 A.M. It was this latter surge that caused 11 of the No. 74 type fuses to blow at one time in the Boston office. The operation of most of the heat coils and carbons probably took place at this time, as there was a strong odor of ozone at the frame directly after. The potential changed at the rate of about 100 volts per second and as we were not equipped to measure over 600 volts when the big surge came, it is possible, judging by the rate of change, that the voltage reached somewhere near 800 volts negative, as the needle went off scale at 600 volts and remained off for a period of 4 or 5 seconds. This would be about the time required to reach 800 volts and return to 600 volts again.

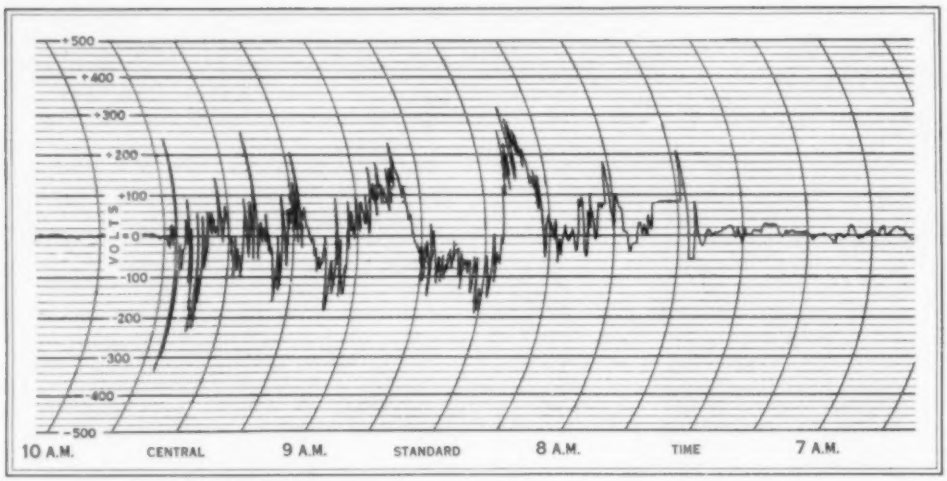



FIG. 7

*The record of the ground potential difference between Minneapolis, Minn., and Fargo, N. D., on the morning of March 24, 1940*

wave circuits on the transatlantic routes were interrupted on Sunday and a number of days thereafter. Figure 9 shows graphically the periods of interrupted service on the transatlantic route on March 24 and 25. Radiotelephone services to South America and across the Pacific were affected considerably less than those across the Atlantic, and service to the Caribbean region through Miami, and coastal and harbor radiotelephone services were practically free from interruptions. Radio disturbances

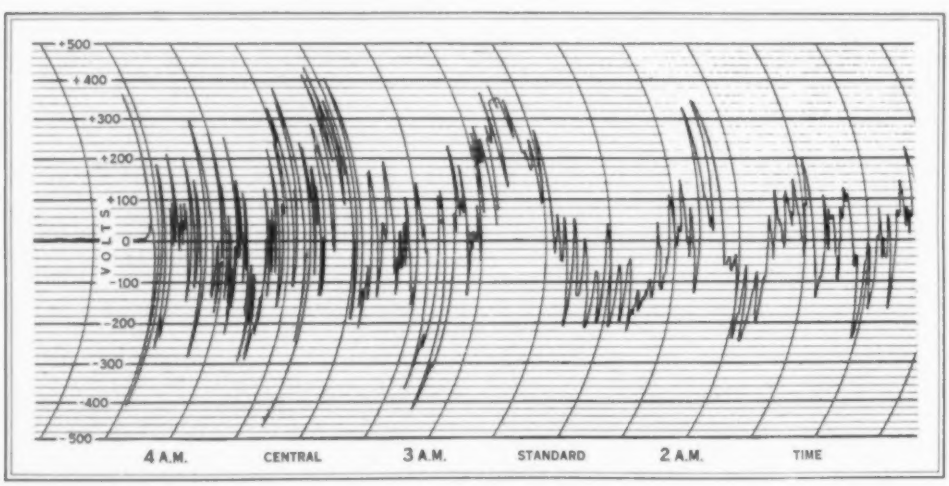



FIG. 8

*The similar record on the following morning*

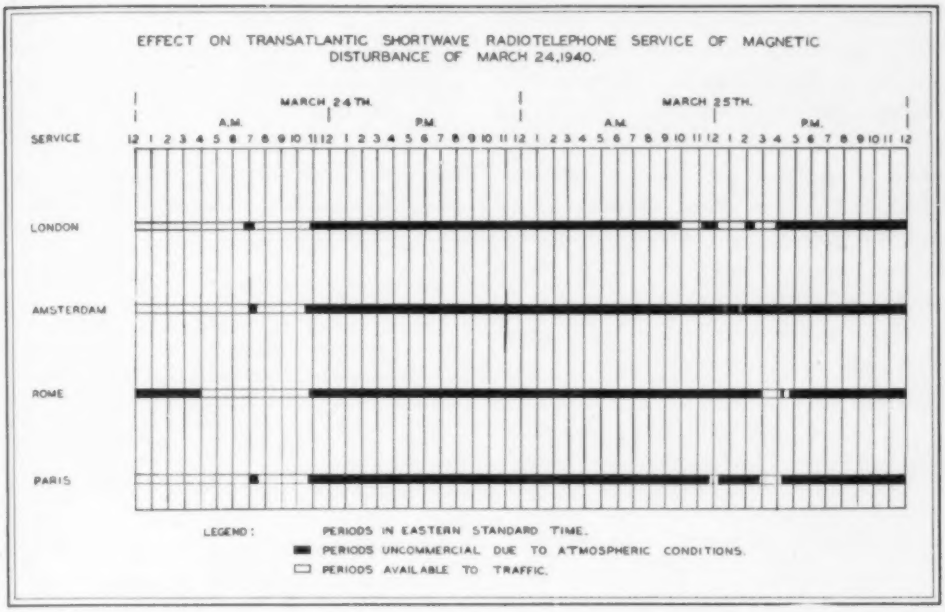

EFFECT ON TRANSATLANTIC SHORTWAVE RADIOTELEPHONE SERVICE OF MAGNETIC DISTURBANCE OF MARCH 24,1940.
MARCH 24TH.
MARCH 25TH.
A.M.
P.M.
A.M.
P.M.
SERVICE
12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12
LONDON
AMSTERDAM
ROME
PARIS
LEGEND:
PERIODS IN EASTERN STANDARD TIME.
PERIODS UNCOMMERCIAL DUE TO ATMOSPHERIC CONDITIONS.
PERIODS AVAILABLE TO TRAFFIC.

FIG. 9

*Interruptions to transatlantic radiotelephone service on March 24 and 25*

also increase towards the upper latitudes, which accounts for the greater effects on the transatlantic circuits.

Only a small portion of the telegraph services of the Bell System is normally handled over grounded telegraph circuits. Some of these services, which had not already been arranged to operate on a metallic or on a balanced wire basis, were affected for brief periods. Long distance telephone and telegraph circuits which were operated on a metallic basis were affected in the manner explained previously through the operation of protective equipment and the reduction in their insulation to ground. This included in some cases carrier systems which were operating on such metallic facilities. Some of the major network broadcasting facilities were affected at times by noise, cut-outs, and scratches, and in certain sections the means for reversing the direction of transmission on program facilities from a remote point was affected, making it necessary to resort to manual operation at intermediate points. Some of the effects of the magnetic storm were also experienced on the wire photo networks. Due to the relatively short distances involved in exchange area services, these services were not noticeably affected by the storm.

### *Actual Damage Was Slight*

In spite of many temporary interruptions and reactions on service, actual physical damage to plant or equipment was very small. In general, the protective apparatus in the wire plant functioned effectively and,

although thousands of protector blocks were grounded, very little damage to telephone apparatus in the numerous central offices resulted. Individual circuit failures were matters of minutes, or at the most hours. Restoration of service was expedited by rapidly increasing the operating personnel, many of whom would not normally be working on Sunday.

The comparative rarity and short duration of great magnetic storms such as that which occurred on the 24th of March probably makes it impracticable to guard completely against their temporary effects. However, Bell System engineers are continuing their study of the record of this and other magnetic storms with a view to reducing or avoiding such reactions and thus further increasing the dependability of Bell System communication services.

In this article the author has drawn on a number of sources concerning the general theory of magnetic storms and the specific reactions resulting from the storm of March 24. He acknowledges these, and also expresses his appreciation of the assistance of his associate, Mr. A. M. Dowling.

# THE CONQUEST OF A CONTINENT

*The Successive Means Which Have Been Devised for Coast-to-Coast Communication Have Been Fundamental to the Growth of This Country and to Its Unity as a Nation*

By ROBERTSON T. BARRETT

PART I

THE year 1940 marks the twenty-fifth anniversary of the opening of the first transcontinental telephone line, on January 25, 1915: an event which forms a part of what we Americans have come to call "the conquest of a continent."

The dramatic story of how that first coast-to-coast telephone line was conceived, planned, built, and officially put into service has been told elsewhere.* The place which the first transcontinental telephone line, and those which have followed it, hold in the over-all picture of communication across the continent has not, however, been discussed as fully. The present article has been prepared in the hope that it may afford a clearer understanding of the background for the drama which was enacted a quarter of a century ago when the human voice first spanned the distance between the Atlantic and the Pacific.

In Part I, it is proposed to discuss some of the social, political, and economic needs that have brought into being the instrumentalities of communication which, in succession, have been created as means of linking coast with coast. With a single exception (which does not deal with overland communication) the instrumentalities discussed in detail in Part I will be those which have not involved the use of steam, electricity, or other forms of invention more advanced than harness and wheel. Part II will deal with those means of communication which have been made possible by the application of invention and scientific research to the problems involved in this peaceful conquest of the North American continent.

This process has been a very long one. Its beginning was foreshadowed when, in 1513, Balboa made his way across the Isthmus of Panama, waded out into the waters of what we know as the Pacific and, raising his sword aloft, proclaimed:

> "Long live the high and mighty sovereigns of Castile! Thus in their names I take possession of these seas and regions."

A colorful and dramatic bit of play-acting, to be sure, but one that, viewed in retrospect, seems a bit fatuous. Seas are not so subdued; continents

* "A Quarter-Century of Transcontinental Telephone Service," QUARTERLY, January, 1940.

are not so conquered. Not even by the march of armored conquistadores are they brought into subjection. Continents are won by the slow and often painful process of clearing wildernesses, establishing homes, building towns—and laying out roads and other facilities for communication which will link these towns with other towns.

### *Their Faces Ever Westward*

THE importance of Balboa's exploit lay not in the picturesqueness of the ceremony but in the fact that he had provided evidence that there *was* another ocean to the westward of the continent which Columbus had discovered. From that moment onward, every explorer of the Atlantic coast of North America saw in each deep bay or wide river that he came upon a possible passage to the Pacific. From that moment, succeeding waves of white men who settled in what is now the United States became, as it were, continent-conscious. They thought of this new region to which they had come to make their homes as a place of vast distances, with a sea on either side. With the ocean that lay to its east the first settlers were all too familiar, for they had been months in crossing it. But the sea that lay to the west had the glamor of the unknown. It seemed to have for the white man an almost magnetic attraction. Partly through a desire for more "elbow-room," partly through economic pressure as opportunities for making a living were diminished by increasing population, more and more people turned their faces westward and began their march toward the Pacific.

Thus, as early as 1635, a company of emigrants from the Massachusetts Bay Colony set out for the Connecticut valley, impelled, John Winthrop tells us, by their lack of grazing lands, the danger that Connecticut would fall into other hands, and *"the strong bent of their spirits to remove thither."*

This westward urge was, indeed, in part spiritual in its nature, and not due entirely to economic or other material causes. It was born of the restlessness, the love of freedom, of those who are destined to become pioneers. It was a part of the stuff of which the American democracy was made. They who are prompted to seek wider geographic horizons are not easily satisfied with political horizons any narrower than those afforded by a government in which people, not potentates, are the rulers. This "strong bent of their spirits to remove" toward the Pacific was a potent factor in the making of America.

BUT these pioneers had another quality, hardly less spiritual than their desire for more breathing-space, more freedom. It was their determination *not* to be cut off entirely from that which they left behind as they turned their faces toward the west. Impelled by a sort of racial nostalgia, they turned the trails over which they marched into roads that would enable them to keep in touch with the friends in the regions whence they had come or through which they had passed. They thus laid what might be called the social foundations for an American communication system—a system which grew in extent and efficiency as needs increased during the passing years.

"THE STRONG BENT OF THEIR SPIRITS TO REMOVE THITHER"

*The departure of a company of emigrants from the Massachusetts Bay Colony for the Connecticut valley in 1635. From a drawing made for the "Telephone Almanac" of 1929*

There were political foundations, as well. Here in America there was destined to be brought into being a government not of emperors or kings or czars. It was to be ruled by the people. As Simeon Strunsky has written, in "The Living Tradition," it was to be held together by "one cohesive force which lies wholly outside the realm of steam and rail and wire, but has not failed to profit by such physical agencies. That was the binding force of an Idea. It was the spirit of union pervading the atmosphere of the Thirteen Colonies, the sense of common destiny, the feeling of participation in the building of a United States long before there was a United States."

This spiritual quality of a sense of nationhood, this instinct for interdependence, was one of the reasons why men first built roads, then inaugurated mail services by stage coach or pony express riders; why they invented telegraphs, telephones, and airplanes.

THESE communication facilities with which we Americans have spanned the continent, by transmitting ideas and thus affording a basis for informed public opinion, have played an important role in our national history. But to say this is not at all to imply that, by reason of them, all Americans ever have thought alike, or ever will.

In June, 1846—two years after Morse had transmitted his historic message, "What hath God wrought!"—a writer in the *New York Express* had this to say:

> "The power of the states will be broken up in some degree by this intensity of communication, and the Union will be solidified at the expense

of the State sovereignties. We shall become more and more one people, thinking more alike, acting more alike and having one common impulse."

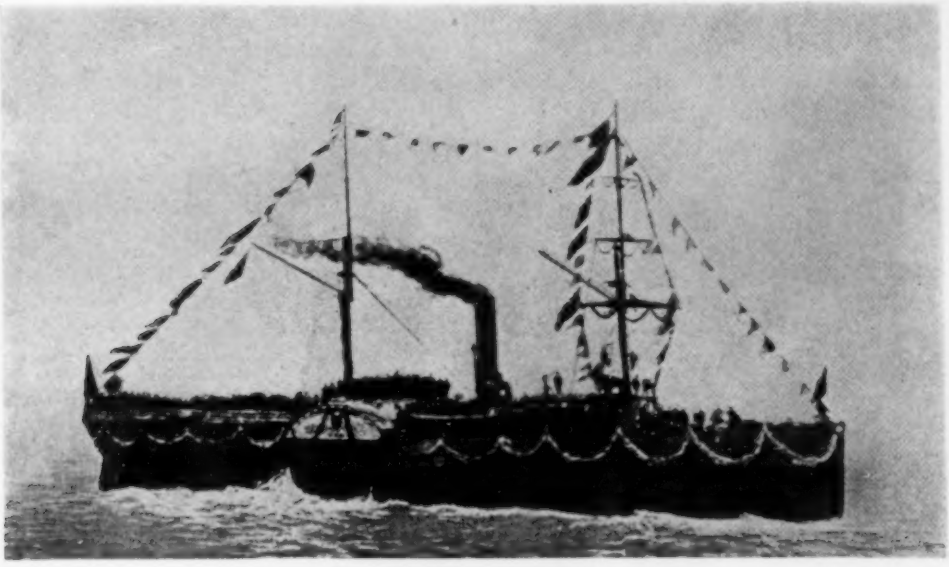
Yet within twenty years after that paragraph was written, a bitter war had been fought because Americans had definitely *not* come to think and act alike, and because the question of state sovereignty had distinctly *not* been settled. Even now, we Americans do not spend our time telephoning or telegraphing each other in regard to national issues. We frequently avail ourselves of the privilege of turning off the radio when a political speaker irritates or bores us. Certainly we do not ride from New York to California by rail or airplane merely to find out what people on the Pacific coast think of the latest questions before Congress. And if we did, we would still exercise the democratic right of adhering to our own opinions. Yet the fact remains that the very existence of these nation-spanning systems of communication does give us a sense of national solidarity, just as a telephone in one's bedroom gives one a sense of security, though it may never be used to call the police to arrest a burglar who is prowling around downstairs. Potentially, as well as actually, these communication services are national assets of incalculable value.

### *Pioneering and Economics*

BUT if the early forms of communication, and those which have followed them, were brought into being in part for social reasons, and in part for political reasons, they were brought into being much more certainly for economic reasons. Every new region into which these westward-marching pioneers penetrated became simultaneously a source of supply of products which had to find a market, and a place of consumption for products from the areas already settled and developed industrially. Over such highways as Pennsylvania's Lancaster Turnpike, for instance, went many hundreds of passengers, and many pounds of mail. But over them, too, toward the Alleghenies and back from them, went tons and tons of freight.

It was the function, or one of the functions, of these communication facilities, to move goods to market; to make available the necessities or the luxuries which a rising standard of living demanded. It is still true that our common carriers transport far more freight than passengers. It is certainly true that, as to long distance service in particular, the great bulk of telephone traffic is made up of conversations in regard to business. Except at holiday times, most telegrams are sent from and to business houses. America has her nation-wide communication systems because the needs of commerce and industry, as well as needs that are social and political in their nature, demand such systems, and can be met with nothing less.

In the present article let us consider the process of evolution by which these needs have arisen, and the parallel process of evolution by which communication facilities have, in turn, been brought into being to meet them. We must confine our discussion to organized systems of communication, excluding more than a brief reference to such exploits as that of Lewis and Clark, and the overland journeys of the parties sent to the Pacific by the



THE STEAMSHIP *CALIFORNIA*

*This was the first mail steamer to reach the Pacific coast, sailing from New York on October 6, 1848, by way of Cape Horn and arriving at San Francisco on February 28, 1849. She and two other vessels of the Pacific Mail Steamship Company carried mail on the Panama–San Francisco–Astoria route. From "The Pioneer Steamer California," by Victor M. Berthold*

shrewd Astor, which were not primarily intended as communication projects.

It has been difficult for most writers on the history of communication in America to resist the temptation to elaborate on that which has been colorful and romantic. They have thought in terms of ceremony rather than of service; of the driving of golden spikes, rather than of the carrying of mails, passengers, and freight as a matter of daily routine. They have pictured the drama of Pony Express riders, thundering across the plains, amidst showers of Indian arrows, and too often overlooked the need which the rides of these dauntless couriers were intended to meet.

Let us, for our present purposes, approach the matter somewhat more prosaically—from the standpoint, as has been indicated, of the needs which, in turn, have brought these transcontinental communication services into being; the manner in which these needs have been met; the success of each particular service, in terms of its value in proportion to cost, and as measured in speed of service, efficiency, dependability, and general usefulness.

### *Mails across the Isthmus*

BUT to return to the Isthmus of Panama. By one of those curious coincidences with which history is filled, it was across this narrow neck of land, which separates the northern and southern portions of our hemisphere, that the first organized communication service between the Atlantic and

Pacific coasts of the United States was inaugurated.

Astor's fur traders had established a settlement in the Pacific Northwest, which they named Astoria in his honor, as early as 1811. Other settlers had followed them. The "Oregon question" had been bitterly argued with England, and finally settled in 1846, and in a message dated August 5 of that year, President Polk had said:

> "It is important that mail facilities, so indispensable to the diffusion of information, and for binding together the different portions of our extended Confederacy, should be afforded to our citizens west of the Rocky Mountains."

To meet the need thus voiced, and also the need for building up a fleet of steam merchant vessels which might be converted into fighting ships in case of necessity, an act of Congress was passed, and approved on March 3, 1847, providing for the building of four such vessels. It directed the Secretary of the Navy to contract for the transportation of the United States mails from New York to Chagres, on the Atlantic side of the isthmus, and back, twice a month, for compensation not to exceed $290,000 per annum. He was also authorized to contract for the transportation of mail from Panama to some port in the territory of Oregon, once a month each way. This mail was to be transported in either steam or sailing vessels. Such a contract was made and later assigned to William H. Aspinwall, for a compensation of $199,000 per annum. Aspinwall incorporated the Pacific Mail Steamship Company, which built three steamers for service between Panama and Oregon. The first of these started from New York October 6, 1848, to make its way to the Pacific, by way of Cape Horn. It reached San Francisco on February 28, 1849.

Meanwhile, gold had been discovered in California, thousands of prospectors were crowding into the new El Dorado, and the communication needs of the Pacific coast had thereby been rendered vastly more urgent.

The first mail was transported across the Isthmus of Panama by the New Grenada government at twelve cents a pound. As it was light in volume, it was carried by canoes and on muleback. Later, the Panama Railroad was built, and a contract made with it in 1851 for compensation at the rate of twenty-two cents a pound. In April, 1857, the contract was modified to an annual compensation of $100,000.

### *The First Pacific Mail Steamers*

THE first steamers, in 1849, carried about 6,000 letters, and a large volume of newspaper mail, on each trip. In 1850, about 50,000 letters was the monthly average. In July, 1852, they reached what is said to have been the monthly high of 60,000 letters. The arrival of the mail steamers in California was hailed with enthusiasm by the inhabitants, and newspapers from the east (although weeks old) brought prices which could have been paid only in a land where gold was cheap.

The first rate of postage to the Pacific, provided by an act of March 3, 1847, was forty cents for single letters. General reductions in the postal rate went into effect in 1851, and the rate to California was reduced to six

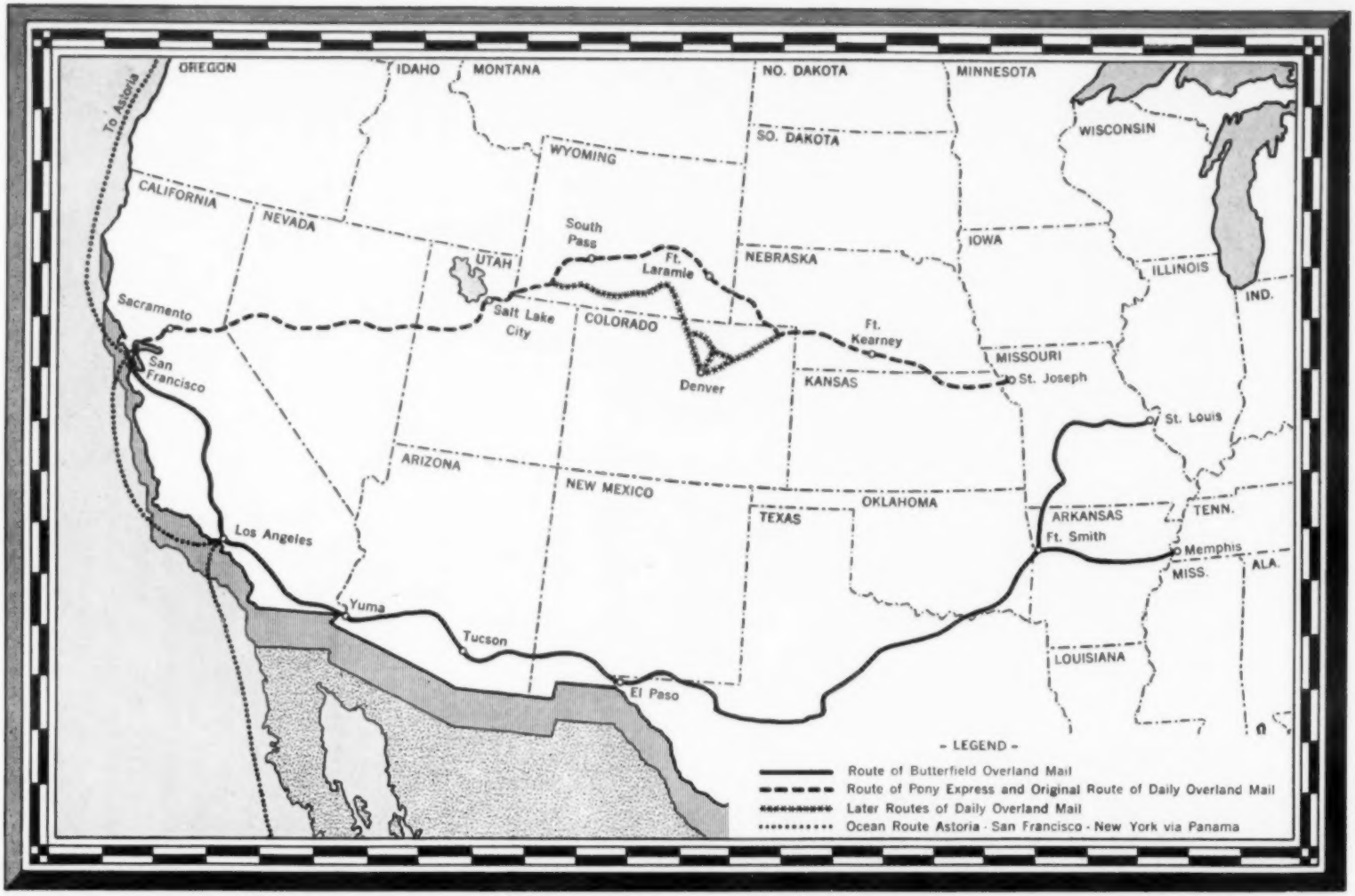
POST OFFICE, SAN FRANCISCO, CALIFORNIA.
A FAITHFUL REPRESENTATION OF THE CROWDS DAILY APPLYING AT THAT OFFICE FOR LETTERS AND NEWSPAPERS.

WAITING FOR MAIL IN SAN FRANCISCO

*This old picture shows a crowd before the post office about the year 1849. Mail from the East was carried by steamer from New York to Chagres, across the Isthmus of Panama by canoe and mule-back (later by railroad), and again by steamer to San Francisco*

cents. This was raised to ten cents in 1855 and remained at that figure until 1863.

THE mails which were carried to and from the Pacific coast by way of Panama were usually about a month in transit. In February, 1858, what seems to have been a record between New York and San Francisco was established when the steamer *Golden Age* reached the latter city with mails that had left the dock in New York twenty-one days, two hours and thirteen minutes before. This really commendable speed record compares most favorably with the best that was credited to the next form of communication across the continent—the famous Overland Mail, which supplemented it but did not supplant it. The relative permanence of the service by steamship was assured by its ability to handle large volumes of newspaper and other mail which did not require speed of transmission and which could not be handled efficiently or economically by other means of transportation that were in use prior to the building of the first transcontinental railroad.




PRINCIPAL PASSENGER AND MAIL ROUTES BETWEEN EAST AND WEST, 1849–1869

### *The Overland Mail*

INDEED, it seems certain that the necessity for greater speed was not the controlling factor in bringing about the establishment of the Overland Mail. Service by steamship, although expensive, had met rather effectively the needs of both the eastern and western coasts of the continent. It did not so well meet the needs of the rapidly developing region that lay in the basin of the Mississippi. More particularly, so far as the eastern seaboard was concerned, it was of especial advantage to the industrial North, where abolitionist theories were gaining strong foothold; it was of far less value to the cotton-raising, slave-holding South. Issues between North and South were becoming more acute, and each was eager to strengthen its ties with the more remote western sections of the country, and particularly with California, which, in the event of open conflict, could supply vast quantities of gold to that side with which it might cast its lot. These facts, it seems certain, explain in part the establishment of the Overland Mail—and go far toward explaining the circuitous route which, as we shall see, its coaches followed between St. Louis and San Francisco, far to the south of a more direct line between these two termini.

A route even more essentially southern had been established a year before the Overland Mail went into operation—that which connected San Antonio, Texas, with San Diego, California, by way of El Paso. Although ostensibly a stage line, its route was in many places almost impassable on wheels, and as late as September, 1858, passengers and mails were being carried between Fort Yuma and San Diego on muleback. When the Overland went into operation, in that same month, it followed the route of the San Antonio-San Diego line between El Paso and Fort Yuma.

Agitation which led to the establishment of the Overland Mail, growing out of discussions of the possibility of a railroad to the Pacific, began as early as 1855. Two years earlier, Congress had authorized surveys of five alternative transcontinental railroad routes, but nothing came of the project until, as we shall see, the Union Pacific was completed, in 1869.

THE data obtained in these railroad surveys, however, furnished impetus to the idea of an overland mail stage service, and provided ammunition for the proponents of one proposed route or another. A petition for such a route was signed by 75,000 residents of California in April, 1856, and the people of Missouri were not less enthusiastic. Overland Mail bills failed in 1855 and 1856, and the proposal was debated heatedly in several successive sessions of Congress.

Finally, on March 3, 1857, amendments to the Post Office Appropriation Bill contained provisions for the establishment of a service "from such point on the Mississippi River as the contractors may select, to San Francisco, at a cost not exceeding $300,000 per annum for semi-monthly, $450,000 for weekly or $600,000 for semi-weekly mails, at the option of the Postmaster General."

The service was to be provided in "good four-horse coaches or spring

wagons" and was to be performed within twenty-five days for each trip. The contractors were given the right to preempt 320 acres of any land not disposed of or reserved at each point necessary for a station, which stations were to be not nearer than ten miles from each other.

Controversy as to the selection of the route was not settled by the passage of the act. Under the law, the contractors had the right to select the route—but the Postmaster General selected the contractors. A Tennesseean, and strong in his pro-southern opinions, Postmaster General Brown selected a route "from St. Louis, Missouri and from Memphis, Tennessee, converging at Little Rock, Arkansas; thence via Preston, Texas, or as nearly so as may be found advisable, to the best point of crossing the Rio Grande, above El Paso, and not far from Fort Fillmore; thence, along the new road being opened under direction of the Secretary of the Interior, to Fort Yuma, California; and thence, through the best passes and along the best valleys for safe and expeditious staging, to San Francisco."

The contract was awarded to John Butterfield and six associates for a semi-weekly mail at an annual compensation of $600,000. The service became one of the few of national importance to which the name of an individual was commonly attached. It was almost universally known as the Butterfield Overland Mail.

So outspoken was the criticism of the route selected, of which the total length was 2795 miles, that the Postmaster General devoted considerable space, in his annual report for 1857, to a justification of his action in giving it preference over other routes. At its most southern point, it dipped about 600 miles below the more direct route through South Pass in Wyoming, and was derisively called the "oxbow" or "horseshoe" by one New York paper.

### *The Service Inaugurated*

ALTHOUGH opinions differed as to the wisdom or fairness of the selection of the route, the formal inauguration of the Overland Mail service, on September 15, 1858, was greeted everywhere with enthusiasm. The first eastbound trip reached St. Louis in twenty-three days and four hours; the westbound trip was made in twenty-four days, eighteen hours and twenty-six minutes.

At first, Concord coaches were used, accommodating four passengers and their baggage and 500 or 600 pounds of mail. Later, more commodious coaches were introduced, carrying six to nine inside passengers and as many as ten outside passengers. When service was inaugurated, the passenger fare was $100 for the through eastward trip and $200 from Memphis or St. Louis to San Francisco. Later, the eastward through fare was raised to $200, then lowered to $150. The differential between eastward and westward fares was due to the fact that most of the demand for passage was from travelers bound for California, many of whom went there to remain permanently. Mail was carried at the rate of one-half ounce for ten cents. By 1860 the Overland Mail was carrying more first-class postal matter than the Panama line of mail steamers. At the height of its prosperity, the Overland had about

THE OVERLAND MAIL STARTING FROM SAN FRANCISCO FOR THE EAST.—[From a Photograph.]

STARTING A TRIP OF THE OVERLAND MAIL
*Reproduced from "Harpers Weekly" of December 11, 1858*

one hundred coaches, seven or eight hundred men—of whom about 150 were drivers—and about 1500 horses and mules.

THERE was never any serious criticism of the operation of the Overland Mail, either as to speed or dependability. But the choice of the southern route continued to be a subject of controversy. Advocates of the central route continued to point out that the southern route was not only circuitous, but that at certain points the problem of providing water and pasturage for horses and mules was a serious handicap. Meanwhile, the political issues out of which this controversy grew were becoming more sharply drawn. Congressional majorities were shrinking into minorities; minorities were becoming majorities. Differences between the North and South were approaching an open break.

Hardly more than a month before Fort Sumter was fired upon, Congress ended the career of the southern route of the Butterfield Overland Mail. On March 2, 1861, presidential approval was given to an act authorizing the Postmaster General to discontinue the service over the southern route and to provide for the conveyance, by the same parties, of a six-times-a-week mail by the central route, that is, "from some point on the Missouri River, connecting with the east, to Placerville, California."

But this decision, so clearly reflecting the stirring political events of the time, had not been made until the practicality of the central route had been demonstrated by one of the most picturesque and romantic of all forms of transcontinental communication—the famous Pony Express.

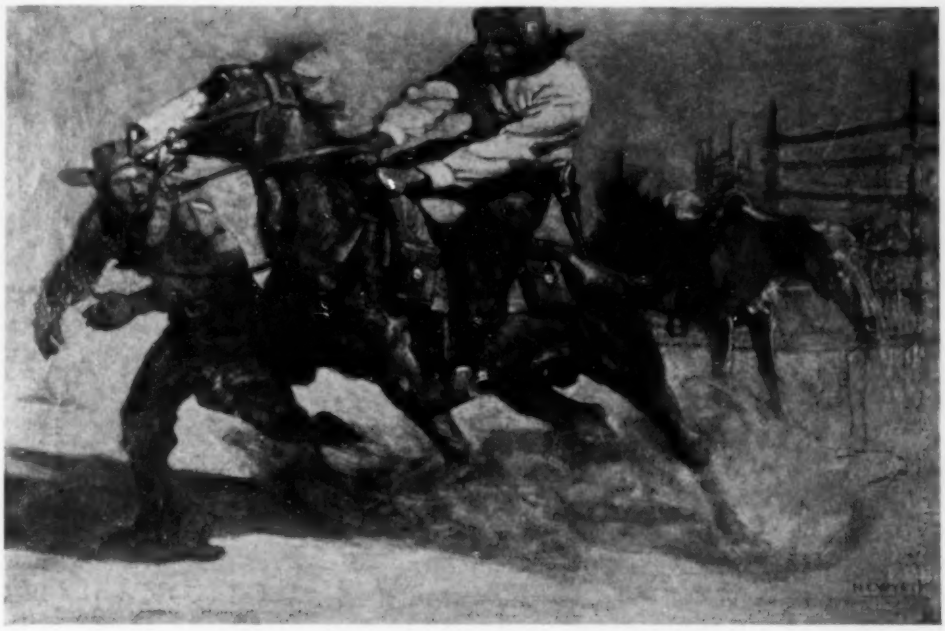
### *The Pony Express*

CURIOUSLY enough, the Pony Express had been in operation almost a year, as a private enterprise, when the above mentioned act of March 2, 1861, gave it governmental support and sanction. It had been inaugurated, if not conceived, by William H. Russell, of the firm of Russell, Majors and Waddell, who were operating a semi-monthly mail line from the Missouri River to Placerville, via Salt Lake City. It seems to have been intended not only to provide speedy service to the Pacific coast, but to demonstrate the practicality of the central route, in the hope that to this route might be transferred the Overland Mail then being handled by Butterfield and his associates over the southern route. Doubtless one of the motives which prompted Russell and his associates to undertake the project, which they did at first at their own expense, was the hope that they might eventually receive the Overland Mail contract. Few enterprises as daring as theirs are undertaken without consideration of the much discussed "profit motive."

Russell seems to have been prompted to take the step which resulted in the establishment of the Pony Express in a conference with Senator William M. Gwin, of California, who contended that it was necessary to prove the feasibility of the central route before he would be able to persuade Congress to authorize a contract over that route in preference to the existing southern Butterfield route.

Be that as it may, Russell, with some difficulty, persuaded his partners to join him and on January 27, 1860, announced that he had decided to establish the Pony Express line. Preparations for the inauguration of the line got under way at top speed, and by March 17 advertisements appeared in San Francisco papers announcing that service would begin on April 3. The announcement added that the schedule time from San Francisco to New York was: for telegraph dispatches—which were carried, of course, only between the two terminal points of the telegraph lines—nine days; for letters, thirteen days. The announced rates for both letters and telegraph dispatches were: between San Francisco and Salt Lake City, three dollars per half ounce and under, and to all points beyond Salt Lake City, five dollars per half ounce and under, and at these rates according to weight.

WITHOUT going too minutely into details, the route may be described as running westward from St. Joseph, Mo., via the valley of the Platte River to Fort Kearney, Julesburg, Fort Laramie, South Pass, and Fort Bridger, to Salt Lake City. From this point it ran, a little south of due west, through Carson City, over the Sierra Nevadas to the south of Lake Tahoe, to Placerville, and thence to Sacramento. From this point the mail was taken by boat to San Francisco.



THE PONY EXPRESS

*From an oil painting by N. C. Wyeth owned by the American Telephone and Telegraph Company and used in its national advertising twenty-eight years ago*

A way bill of the first westward trip shows that the mail left St. Joseph at 6:30 on April 3, as announced; reached Salt Lake City at 6:30 on the ninth; Carson City at 2:30 on the twelfth; Placerville at 2:30 on the thirteenth; Sacramento at 5:30 on the same day; and San Francisco, 1:00 a.m. on the fourteenth. For the first time in history, mails had covered half the width of the continent in a little over ten days.

Figures on the volume of mail handled by the Pony Express riders are difficult to obtain. It is stated that on an average, forty-one letters per trip were carried to the Pacific coast between November, 1860, and April, 1861. From April, 1861, to July of that year, the average was sixty-four, and from that date to the termination of the service in October, 1861, the average was ninety. The east bound mail seems to have been much heavier in volume. In April, 1860, 205 letters were sent eastward by a single express.

As has been stated, the original rate for through messages was $5.00 per half ounce or fraction thereof. In August, 1860, and thereafter, one-fourth ounce letters were carried for $2.50 each. In April, 1861, the rates were reduced to $2.00 per half ounce. After July 1, 1861, the rate for half-ounce letters was reduced to $1.00.

As a financial enterprise, the Pony Express did not succeed. It seems obvious enough, from an examination of the rates above quoted, together with figures as to volume of traffic, that there must have been much truth in the statement of Alexander Majors,

one of Russell's partners, that "the business transacted over this line was not sufficient to pay one tenth of the expenses, to say nothing about the capital invested." The initial cost of equipping the line has been stated to have been $100,000; the cost of maintenance, $480,000; additional expense due to the Washoe Indian War in Nevada, in which stations were burned and stock driven off by savages, $75,000; and miscellaneous expenses, $45,000, making a total of $700,000. All of these expenses were borne by the Russell firm up to the time when the act of March 2, 1861, became effective. In addition to providing for the carrying of a daily stage mail over the central route, this law provided for a semi-weekly Pony Express, and thus gave the Russell enterprise a belated blessing. The compensation for the joint undertaking was fixed at $1,000,000 per annum.

IRONICALLY, the contract for operating the Pony Express was not awarded to Russell and his associates, though they had operated the enterprise, at their own expense, with conspicous success—from the standpoint of demonstrating the practicality of the central route, which seems to have been one of its main purposes. The Butterfield concern was given the contract for both the overland mail and the Pony Express. An arrangement between the Butterfield and Russell organizations was made, however, under which Russell and his partners operated the Pony Express and the daily mail coach service from the Missouri to Salt Lake City and the Overland Mail (Butterfield) Company operated the service from Salt Lake City westward. The law specifically provided that the Pony Express service should be continued only until the completion of the Overland telegraph. As we shall see, this took place in October, 1861.

### *A Precious Heritage*

IT is not within the purpose of the present article to dwell at length on the heroism of the Pony Express riders, or to pay tribute to the originators and operators of the line for the service which they performed in operating it. On this point it may perhaps be sufficient to quote from "The Overland Mail" by LeRoy R. Hafen:

> "From the standpoint of the nation, the Pony Express was eminently successful. It demonstrated the practicability of the Central route and marked the path for the first transcontinental railroad. By shortening the distance between the Atlantic and the Pacific coasts it helped to unite the Pacific and the Rocky Mountain region to the Union during the first ominous year of the Civil War. It showed the conquest of the West in one of its most spectacular phases, and is an act in the great Western drama that will always be recalled as one of our most precious heritages."

With the last trips of the Pony Express riders, the era of which they were the most glamorous exponents came to a close, and a new era began—the era of which the mechanization of means of speeding the written word, and later the spoken word, was to be the keynote. The instrumentalities of transcontinental communication which belong to this era of steam and electricity will be considered in Part II of this study.

*(To be concluded)*

# TELEPHONE STATISTICS OF THE WORLD

*Figures from the Most Complete Survey of its Kind—Which Show, Incidentally, the High Development of Facilities and the Frequency of Use of the Service in the United States*

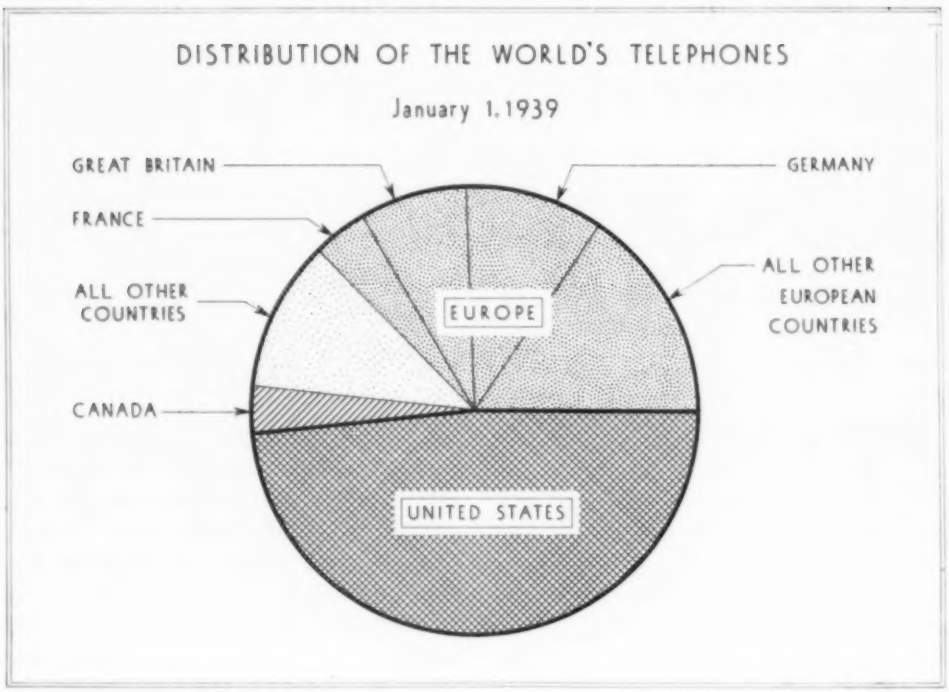
By KNUD FICK

On the basis of official statistics with respect to the telephone systems in this country and abroad as of January 1, 1939, it may safely be estimated—with allowance for war-time conditions—that more than 43,000,000 telephones are in service throughout the world at the present time. Nearly two-fifths of these telephones are owned and operated by the Bell System in the United States, and more than 93 per cent of all telephones in the world can be reached (except for war restrictions in some foreign countries) from any Bell System telephone. On the basis of present calling rates, approximately 65,000,000,000 local and long distance calls per year are made over the world's telephones.

The latest complete data regarding world telephone facilities were recently published by the American Telephone and Telegraph Company in a pamphlet entitled "Telephone and Telegraph Statistics of the World, January 1, 1939." This publication, the most complete survey of its kind, is based upon extensive information gathered by the Chief Statistician's Division from the organization or organizations, private or governmental, which operate telephone or telegraph systems in each foreign country. A number of tables and charts shown in that pamphlet are reproduced in the following pages.

During 1938, the total number of telephones in the world increased some 4.7 per cent, from 39,245,069 to 41,090,347. Slightly over 53 per cent of all telephones on January 1, 1939, were connected to automatic exchanges, including 9,150,000 dial telephones in this country. Associated with the total of 41,090,347 telephones were 174,548,000 miles of telephone wire, some 6,000,000 miles more than the year before, and equivalent to more than 400 feet of wire for every one of the world's inhabitants. The United States, with 19,953,263 telephones, accounted for 48.56 per cent of the world's total number of instruments and for 53.20 per cent of the world's telephone wire, although this country has only 6 per cent of the total number of people in the world.

On January 1, 1939, Europe, with 4½ times the population of the United States, had a total of 15,305,459 tele-



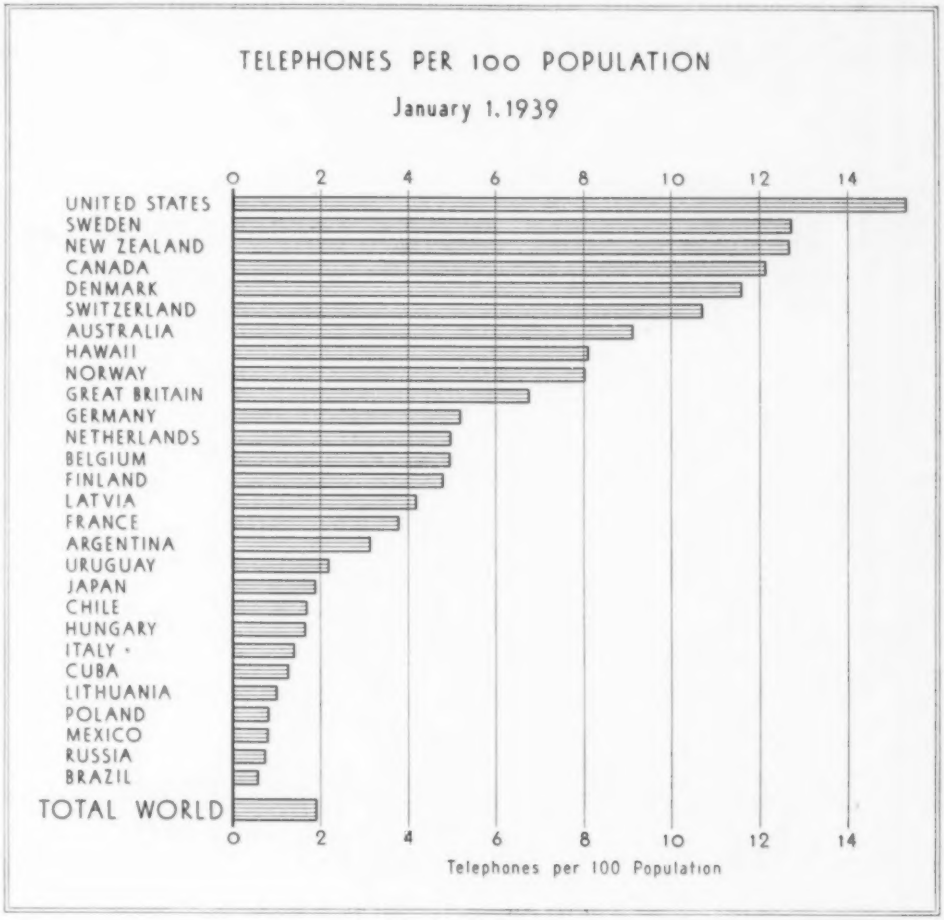

phones (including 9,840,000 dial telephones) and 59,033,000 miles of telephone wire, representing 37.25 and 33.82 per cent, respectively, of the world totals of telephones and wire. In the United States, there was an average of 4.65 miles of telephone wire per telephone, compared to 3.86 miles per telephone in the world outside the United States.

About three-fifths of the world's telephones were owned and operated by private companies, including 4,548,726 privately operated telephones outside the United States. Nearly 81 per cent of the 16,588,358 telephones in government-owned systems were in Europe.

Referring to the table "Telephone Development of the World, by Countries," it will be seen that the largest national telephone systems outside the United States, in the order of their size, were in Germany, Great Britain, France, Japan, Canada and Russia, these being the only countries with more than a million telephones each. In order to make allowance for the differences in the sizes of the various nations, telephone development is conventionally expressed as a ratio between population and number of telephones. A glance at the chart headed "Telephones per 100 Population" will show that the foreign countries with large telephone systems are not necessarily those with the most telephones in relation to population. Thus, the countries where the number of telephones correspond to more than 10 per cent of the population were, in the order of relative development, the United States, Sweden, New Zealand, Canada, Denmark and Switzerland.

The United States had 15.37 telephones per 100 population, a telephone development 21 per cent better than the next highest ranking system.

In this connection it is of interest to note that the largest five telephone systems operating wholly or predominantly under private ownership (namely, those in the United States, Canada, Italy, Denmark and Argentina) had an over-all telephone development of 11.38 telephones for each 100 of their combined population, compared with an aggregate development of 2.81 telephones per 100 population for the largest five countries in which telephone service is operated by a department of the national government. These latter countries (Germany, Great Britain, France, Japan and Russia) contain, in the aggregate, one-fifth of the world's population, or more than twice as many people as are served by the largest five private systems. The latter systems, however, have twice as many telephones in service. Telephone wire similarly averaged 0.55 miles per capita in the five privately owned systems and only 0.11 miles per capita



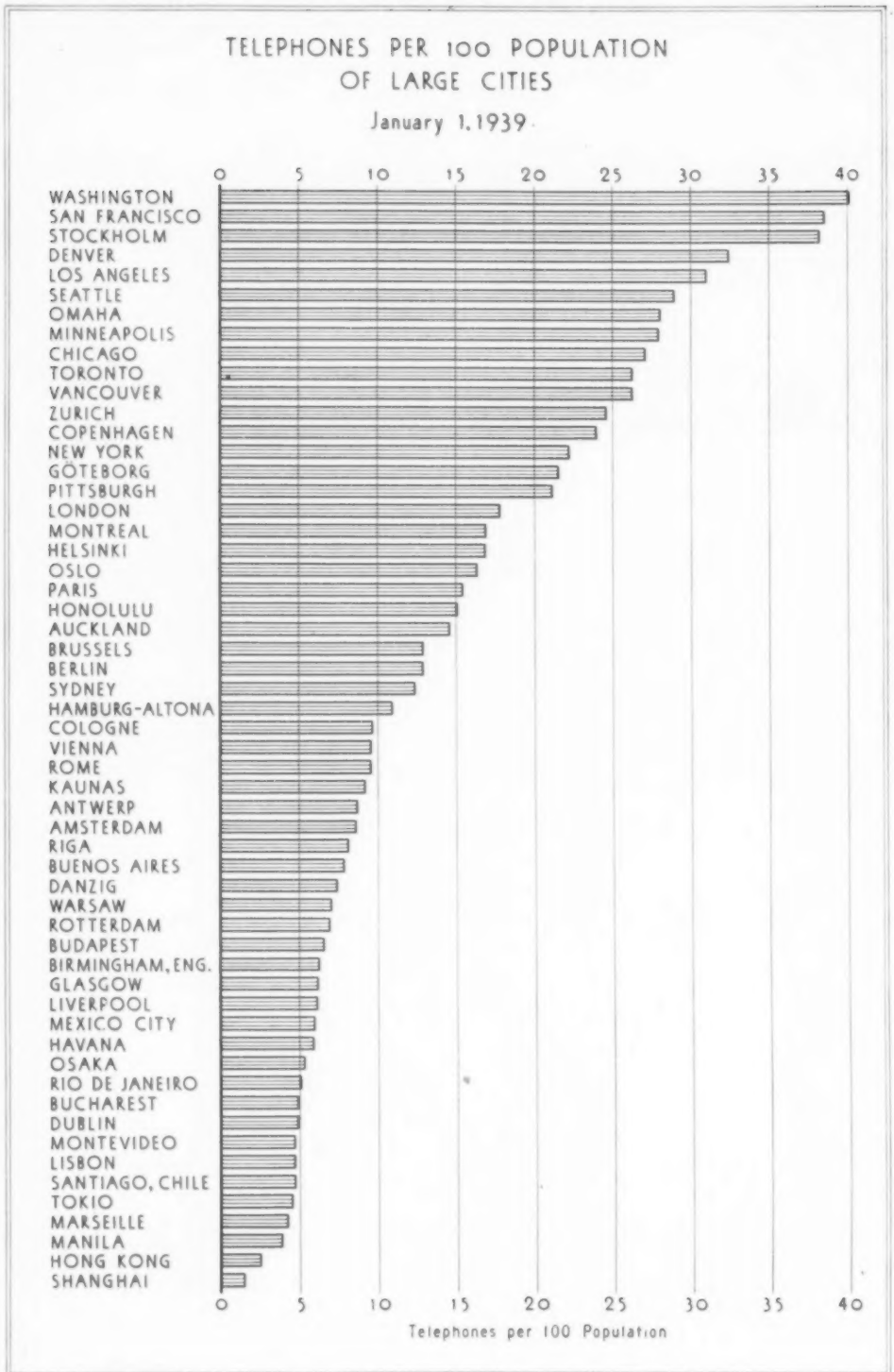
## TELEPHONE DEVELOPMENT OF THE WORLD, BY COUNTRIES, JANUARY 1, 1939

| Countries | Number of Telephones: Government Systems | Number of Telephones: Private Companies | Number of Telephones: Total | Per Cent of Total World | Telephones Per 100 Population |
|---|---|---|---|---|---|
| NORTH AMERICA: | | | | | |
| United States | — | 19,953,263 | 19,953,263 | 48.56% | 15.37 |
| Canada | 205,846 | 1,153,571 | 1,359,417 | 3.31% | 12.13 |
| Central America | 13,131 | 17,999 | 31,130 | .07% | 0.40 |
| Mexico | 1,337 | 157,232 | 158,569 | .39% | 0.81 |
| West Indies— | | | | | |
| Cuba | 610 | 53,543 | 54,153 | .13% | 1.29 |
| Puerto Rico | 531 | 15,170 | 15,701 | .04% | 0.86 |
| Other Places in the West Indies | 9,042 | 18,838 | 27,880 | .07% | 0.36 |
| Other Places in North America | — | 17,014 | 17,014 | .04% | 4.40 |
| Total | 230,497 | 21,386,630 | 21,617,127 | 52.61% | 11.85 |
| SOUTH AMERICA: | | | | | |
| Argentina | — | 405,474 | 405,474 | .99% | 3.13 |
| Bolivia | — | 2,595 | 2,595 | .006% | 0.08 |
| Brazil | 1,000 | 255,467 | 256,467 | .62% | 0.59 |
| Chile | — | 78,119 | 78,119 | .19% | 1.69 |
| Colombia | 8,500 | 30,333 | 38,833 | .10% | 0.44 |
| Ecuador | 4,276 | 3,050 | 7,326 | .02% | 0.29 |
| Paraguay | — | 3,339 | 3,339 | .01% | 0.35 |
| Peru | — | 29,318 | 29,318 | .07% | 0.43 |
| Uruguay | 34,810 | 11,846 | 46,656 | .11% | 2.20 |
| Venezuela | 702 | 23,102 | 23,804 | .06% | 0.67 |
| Other Places in South America | 3,018 | — | 3,018 | .007% | 0.54 |
| Total | 52,306 | 842,643 | 894,949 | 2.18% | 1.00 |
| EUROPE: | | | | | |
| Belgium | 415,522 | — | 415,522 | 1.01% | 4.95 |
| Bulgaria | 29,576 | — | 29,576 | .07% | 0.46 |
| Denmark | 18,607† | 424,391 | 442,998 | 1.08% | 11.61 |
| Finland | 7,720 | 177,736 | 185,456 | .45% | 4.79 |
| France | 1,589,595 | — | 1,589,595 | 3.87% | 3.79 |
| Germany† | 4,146,489 | — | 4,146,489 | 10.09% | 5.20 |
| Great Britain and No. Ireland | 3,220,241 | — | 3,220,241 | 7.84% | 6.77 |
| Greece | 6,273 | 43,599 | 49,872 | .12% | 0.71 |
| Hungary | 164,572 | 790 | 165,362 | .40% | 1.64 |

| | | | | | |
|---|---|---|---|---|---|
| Ireland (Eire)† | 43,086 | — | 43,086 | .11% | 1.47 |
| Italy | — | 611,254 | 611,254 | 1.49% | 1.41 |
| Latvia† | 83,650 | — | 83,650 | .20% | 4.20 |
| Lithuania | 26,591 | — | 26,591 | .06% | 1.03 |
| Netherlands | 433,927 | — | 433,927 | 1.06% | 4.97 |
| Norway* | 143,642 | 91,622 | 235,264 | .57% | 8.03 |
| Poland | 160,251† | 134,577 | 294,828 | .72% | 0.84 |
| Portugal | 18,158 | 51,098 | 69,256 | .17% | 0.91 |
| Roumania | — | 93,314 | 93,314 | .23% | 0.47 |
| Russia¶ | 1,272,500 | — | 1,272,500 | 3.10% | 0.75 |
| Spain | — | 300,000 | 300,000 | .73% | 1.19 |
| Sweden | 801,562 | 1,666 | 803,228 | 1.95% | 12.73 |
| Switzerland | 450,380 | — | 450,380 | 1.10% | 10.72 |
| Yugoslavia | 67,588 | — | 67,588 | .16% | 0.43 |
| Other Places in Europe | 275,482 | — | 275,482 | .67% | 1.66 |
| Total | 13,375,412 | 1,930,047 | 15,305,459 | 37.25% | 2.67 |
| ASIA: | | | | | |
| British India† | 31,878 | 51,500 | 83,378 | .20% | 0.02 |
| China | 40,000 | 120,000 | 160,000 | .39% | 0.04 |
| Japan† | 1,367,958 | — | 1,367,958 | 3.33% | 1.89 |
| Other Places in Asia | 198,462 | 103,295 | 301,757 | .73% | 0.15 |
| Total | 1,638,298 | 274,795 | 1,913,093 | 4.65% | 0.18 |
| AFRICA: | | | | | |
| Egypt | 64,823 | — | 64,823 | .16% | 0.29 |
| Union of South Africa† | 205,892 | — | 205,892 | .50% | 2.03 |
| Other Places in Africa | 133,508 | 1,350 | 134,858 | .33% | 0.11 |
| Total | 404,223 | 1,350 | 405,573 | .99% | 0.26 |
| OCEANIA: | | | | | |
| Australia* | 630,175 | — | 630,175 | 1.54% | 9.14 |
| Hawaii | — | 33,287 | 33,287 | .08% | 8.10 |
| Netherlands Indies | 45,033 | 4,328 | 49,361 | .12% | 0.07 |
| New Zealand† | 206,216 | — | 206,216 | .50% | 12.69 |
| Philippine Islands | 1,263 | 28,579 | 29,842 | .07% | 0.19 |
| Other Places in Oceania | 4,935 | 330 | 5,265 | .01% | 0.24 |
| Total | 887,622 | 66,524 | 954,146 | 2.32% | 0.99 |
| TOTAL WORLD | 16,588,358 | 24,501,989 | 41,090,347§ | 100.00% | 1.91 |

* June 30, 1938. † March 31, 1939. ¶ U.S.S.R., including Siberia and Associated Republics.

§ Includes approximately 21,900,000 automatic or "Dial" telephones, of which about 42% are in the United States.

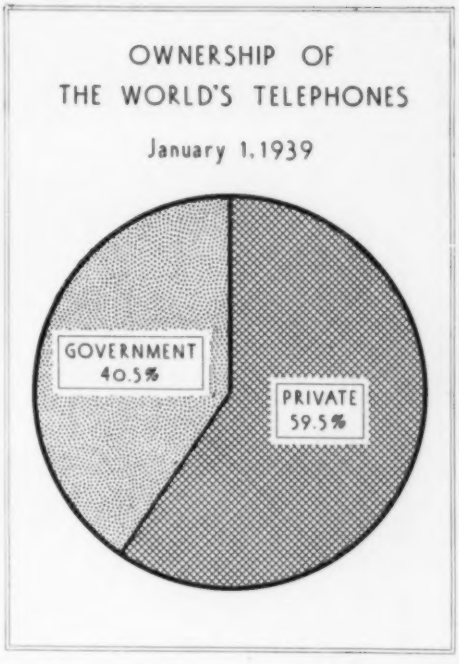

TELEPHONES PER 100 POPULATION
OF LARGE CITIES
January 1, 1939
0 5 10 15 20 25 30 35 40
WASHINGTON
SAN FRANCISCO
STOCKHOLM
DENVER
LOS ANGELES
SEATTLE
OMAHA
MINNEAPOLIS
CHICAGO
TORONTO
VANCOUVER
ZURICH
COPENHAGEN
NEW YORK
GÖTEBORG
PITTSBURGH
LONDON
MONTREAL
HELSINKI
OSLO
PARIS
HONOLULU
AUCKLAND
BRUSSELS
BERLIN
SYDNEY
HAMBURG-ALTONA
COLOGNE
VIENNA
ROME
KAUNAS
ANTWERP
AMSTERDAM
RIGA
BUENOS AIRES
DANZIG
WARSAW
ROTTERDAM
BUDAPEST
BIRMINGHAM, ENG.
GLASGOW
LIVERPOOL
MEXICO CITY
HAVANA
OSAKA
RIO DE JANEIRO
BUCHAREST
DUBLIN
MONTEVIDEO
LISBON
SANTIAGO, CHILE
TOKIO
MARSEILLE
MANILA
HONG KONG
SHANGHAI
0 5 10 15 20 25 30 35 40
Telephones per 100 Population

in the government operated systems, while telephone traffic amounted to 175 and 35 annual messages per capita, respectively.

United States cities continue in the lead among all the cities in the world, as far as telephone facilities are concerned, both in actual number and in relation to population. New York City, with an estimated population of 7,333,000 at the beginning of 1939, had 1,632,348 telephones,—more than any other city in the world and, in fact, more telephones than in all of France. Greater London is about 30 per cent more populous than New York City, but New York City had 38 per cent more telephones. The central part of London, with only a little over 4,000,000 people, had 717,-468 telephones, whereas Chicago, with a population of 3,550,000, had 962,-351 telephones, or 27.11 per 100 inhabitants, compared with 17.81 in central London.

Berlin's population of 4,339,000 was served by 599,911 telephones, or only 13.83 per 100 population. Paris, with a population of 2,830,000, had 437,139 telephones, or 15.45 telephones per 100 inhabitants. More than 100 large cities in this country had a telephone development superior to that of any one of these three European capitals.

The world's leading cities, in point of relative telephone development, are to be found in the United States. Among large cities, Washington, D. C., ranked first, with 40.14 telephones per 100 population, and San Francisco second, with 38.53 telephones per 100 population. Outstanding among foreign cities in this respect was Stockholm, Sweden, with 32.64 telephones per 100 inhabitants within its telephone exchange area, and 38.28 in the city of Stockholm proper.




Not only is the telephone development of foreign countries everywhere below that of the United States, but elsewhere a greater proportion of the telephone facilities is frequently concentrated within the large metropolitan centers. Thus, one-third of all French telephones are in metropolitan Paris, more than a third of all those in Great Britain are in Greater London, more than a fourth of those in Sweden are in Greater Stockholm, etc. In this country, only about 8 per cent of all telephones are in New York City and less than 5 per cent in Chicago. The corollary of this situation is that the telephone facilities of those foreign communities which are less densely populated appear, in most

## TELEPHONE DEVELOPMENT OF LARGE CITIES, JANUARY 1, 1939

| Country and City (or Exchange Area) | Estimated Population (City or Exchange Area) | Number of Telephones | Telephones Per 100 Population |
|---|---|---|---|
| ARGENTINA: | | | |
| Buenos Aires | 3,200,000 | 252,400 | 7.89 |
| AUSTRALIA: | | | |
| Adelaide | 321,000 | 35,935 | 11.19 |
| Brisbane | 326,000 | 35,805 | 10.98 |
| Melbourne | 1,036,000 | 135,518 | 13.08 |
| Sydney | 1,289,000 | 159,825 | 12.40 |
| BELGIUM:# | | | |
| Antwerp | 560,000 | 48,696 | 8.70 |
| Brussels | 991,000 | 127,639 | 12.88 |
| Liege | 433,000 | 29,885 | 6.90 |
| BRAZIL: | | | |
| Rio de Janeiro | 1,900,000 | 95,603 | 5.03 |
| CANADA: | | | |
| Montreal | 1,079,000 | 183,103 | 16.97 |
| Ottawa | 198,200 | 39,227 | 19.79 |
| Toronto | 803,300 | 211,601 | 26.34 |
| Vancouver | 286,100 | 75,354 | 26.34 |
| CHILE: | | | |
| Santiago | 850,000 | 40,109 | 4.72 |
| CHINA: | | | |
| Hong Kong | 800,000 | 20,322 | 2.54 |
| Shanghai†† | 4,000,000 | 63,355 | 1.58 |
| CUBA: | | | |
| Havana | 724,000 | 42,937 | 5.93 |
| DANZIG: | | | |
| Free City of Danzig | 253,000 | 18,792 | 7.43 |
| DENMARK: | | | |
| Copenhagen | 883,000 | 211,156 | 23.91 |
| FINLAND: | | | |
| Helsinki | 305,000 | 51,328 | 16.83 |
| FRANCE: | | | |
| Bordeaux | 260,000 | 23,311 | 8.97 |
| Lille | 200,000 | 18,566 | 9.28 |
| ITALY: | | | |
| Bologna | 315,000 | 14,738 | 4.68 |
| Milan | 1,206,000 | 109,168 | 9.05 |
| Naples | 920,000 | 31,373 | 3.41 |
| Rome | 1,280,000 | 122,442 | 9.57 |
| Venice | 284,000 | 10,209 | 3.59 |
| JAPAN:† | | | |
| Kobe | 989,000 | 46,265 | 4.68 |
| Kyoto | 1,160,000 | 51,457 | 4.44 |
| Nagoya | 1,224,000 | 46,122 | 3.77 |
| Osaka | 3,321,000 | 176,697 | 5.32 |
| Tokio | 6,458,000 | 290,510 | 4.50 |
| LATVIA:† | | | |
| Riga | 391,000 | 31,795 | 8.13 |
| LITHUANIA: | | | |
| Kaunas | 110,000 | 10,124 | 9.20 |
| MEXICO: | | | |
| Mexico City | 1,447,000 | 86,088 | 5.95 |
| NETHERLANDS: | | | |
| Amsterdam | 794,000 | 67,927 | 8.56 |
| Haarlem | 174,000 | 14,474 | 8.32 |
| Rotterdam | 635,000 | 44,145 | 6.95 |
| The Hague | 540,000 | 57,635 | 10.67 |
| NEW ZEALAND:† | | | |
| Auckland | 213,000 | 31,077 | 14.59 |
| NORWAY:* | | | |
| Oslo | 411,000 | 67,180 | 16.35 |
| PHILIPPINE ISLANDS: | | | |
| Manila | 620,000 | 24,035 | 3.88 |
| POLAND: | | | |
| Lodz | 670,000 | 19,048 | 2.84 |
| Warsaw | 1,270,000 | 90,627 | 7.03 |
| PORTUGAL: | | | |
| Lisbon | 697,000 | 32,988 | 4.73 |

| | | | |
|---|---|---|---|
| Lyon | 650,000 | 39,369 | 6.06 |
| Marseille | 915,000 | 38,801 | 4.24 |
| Paris | 2,830,000 | 437,139 | 15.45 |
| GERMANY:† | | | |
| Berlin | 4,339,000 | 599,911 | 13.83 |
| Breslau | 623,000 | 48,203 | 7.74 |
| Cologne | 771,000 | 75,393 | 9.78 |
| Dresden | 821,000 | 75,569 | 9.21 |
| Dortmund | 585,000 | 28,945 | 4.95 |
| Essen | 672,000 | 36,743 | 5.47 |
| Frankfort-on-Main | 647,000 | 68,112 | 10.52 |
| Hamburg-Altona | 1,724,000 | 188,861 | 10.96 |
| Leipzig | 767,000 | 73,959 | 9.64 |
| Munich | 866,000 | 97,215 | 11.23 |
| Vienna | 1,874,000 | 180,165 | 9.61 |
| GREAT BRITAIN AND NO. IRELAND:† | | | |
| Belfast | 415,000 | 23,336 | 5.62 |
| Birmingham | 1,259,000 | 79,847 | 6.34 |
| Bristol | 450,000 | 31,376 | 6.97 |
| Edinburgh | 465,000 | 47,066 | 10.12 |
| Glasgow | 1,150,000 | 72,359 | 6.29 |
| Hull | 359,000 | 25,134 | 7.00 |
| Leeds | 568,000 | 36,825 | 6.48 |
| Liverpool | 1,265,000 | 79,228 | 6.26 |
| London— | | | |
| (City and County of London) | 4,028,000 | 717,468 | 17.81 |
| Manchester | 1,015,000 | 68,191 | 6.72 |
| Newcastle | 482,000 | 28,167 | 5.84 |
| Sheffield | 522,000 | 28,776 | 5.51 |
| HAWAII: | | | |
| Honolulu | 153,000 | 22,994 | 15.03 |
| HUNGARY: | | | |
| Budapest | 1,635,000 | 107,906 | 6.60 |
| Szeged | 141,000 | 2,635 | 1.87 |
| IRELAND (Eire):† | | | |
| Dublin | 482,000 | 23,928 | 4.96 |
| ROUMANIA: | | | |
| Bucharest | 900,000 | 44,617 | 4.96 |
| SWEDEN: | | | |
| Göteborg | 276,000 | 59,353 | 21.52 |
| Malmö | 151,000 | 27,971 | 18.49 |
| Stockholm | 460,000 | 176,168 | 38.28 |
| SWITZERLAND: | | | |
| Basel | 155,000 | 38,191 | 24.64 |
| Bern | 116,000 | 30,174 | 26.01 |
| Geneva | 151,000 | 30,850 | 20.43 |
| Zurich | 287,000 | 70,573 | 24.59 |
| URUGUAY: | | | |
| Montevideo | 705,000 | 33,447 | 4.74 |
| UNITED STATES: (See Note) | | | |
| New York | 7,333,000 | 1,632,348 | 22.26 |
| Chicago | 3,550,000 | 962,351 | 27.11 |
| Los Angeles | 1,415,000 | 439,258 | 31.04 |
| Pittsburgh | 1,047,000 | 222,063 | 21.21 |
| Total 7 cities over 1,000,000 Population | 18,477,200 | 4,263,891 | 23.08 |
| Milwaukee | 798,000 | 157,437 | 19.73 |
| San Francisco | 732,000 | 282,008 | 38.53 |
| Washington | 597,000 | 239,668 | 40.14 |
| Minneapolis | 521,600 | 145,900 | 27.97 |
| Total 13 cities with 500,000 to 1,000,000 Population | 8,638,300 | 2,105,983 | 24.38 |
| Seattle | 427,500 | 123,752 | 28.94 |
| Denver | 321,000 | 104,156 | 32.44 |
| Hartford | 245,500 | 64,479 | 26.26 |
| Omaha | 237,800 | 66,762 | 28.08 |
| Total 28 cities with 200,000 to 500,000 Population | 8,921,500 | 1,872,574 | 20.99 |
| Total 48 cities with more than 200,000 Population | 36,037,000 | 8,242,448 | 22.87 |

NOTE: There are shown, for purposes of comparison with cities in other countries, the total development of all cities in the United States in certain population groups, and the development of certain representative cities within each of such groups.

* June 30, 1938. # February 28, 1938. † March 31, 1939. †† International Settlement and French Concession.

## TELEPHONE DEVELOPMENT OF LARGE AND SMALL COMMUNITIES, JANUARY 1, 1939

| Country | Service Operated By (See Note) | Number of Telephones | | Telephones Per 100 Population | |
|---|---|---|---|---|---|
| | | In Communities of 50,000 Population and Over | In Communities of less than 50,000 Population | In Communities of 50,000 Population and Over | In Communities of less than 50,000 Population |
| Australia* | G. | 390,700 | 239,475 | 11.66 | 6.76 |
| Belgium# | G. | 278,411 | 115,117 | 7.70 | 2.42 |
| Canada | P.G. | 751,273 | 608,144 | 20.03 | 8.15 |
| Denmark | P. | 237,617 | 205,381 | 21.27 | 7.61 |
| Finland | P. | 70,532 | 114,924 | 13.31 | 3.44 |
| France | G. | 866,080 | 723,515 | 8.17 | 2.31 |
| Germany† | G. | 2,711,165 | 1,435,324 | 8.50 | 3.00 |
| Great Britain and No. Ireland† | G. | 2,322,000 | 950,000 | 8.42 | 4.73 |
| Hungary | G. | 123,384 | 41,978 | 5.10 | 0.55 |
| Japan† | G. | 959,734 | 408,224 | 3.97 | 0.85 |
| Netherlands | G. | 273,747 | 160,180 | 7.37 | 3.20 |
| New Zealand† | G. | 88,079 | 118,137 | 15.24 | 11.28 |
| Norway* | P.G. | 97,781 | 137,483 | 17.18 | 5.82 |
| Poland | P.G. | 189,681 | 105,147 | 4.11 | 0.35 |
| Sweden | G. | 336,737 | 466,491 | 26.81 | 9.23 |
| Switzerland | G. | 218,620 | 231,760 | 22.70 | 7.16 |
| Union of South Africa† | G. | 128,133 | 77,759 | 8.69 | 0.90 |
| United States | P. | 11,150,933 | 8,802,330 | 21.71 | 11.22 |

NOTE: P. indicates that the telephone service is wholly or predominantly operated by private companies, G. wholly or predominantly by the Government, and P.G. by both private companies and the Government. See first table.

* June 30, 1938. # February 28, 1938. † March 31, 1939.

cases, extremely inadequate when compared with American standards. Typical development statistics for European communities with a population of less than 50,000 were 2.31 telephones per 100 population in France, 3.00 in Germany, 4.73 in Great Britain. Canada, Switzerland and the Scandinavian countries had a somewhat better telephone development in the smaller communities than did the large European countries. In similar communities in the United States there were 11.22 telephones for every 100 people—a better telephone development than that to be found in any large city in Asia, Africa or South America and in all but a very few capitals in Europe.

During 1938, nearly 29 billion local and long distance telephone calls were completed in the United States, equivalent to some 223 messages for every man, woman and child in the country or to 1,469 calls per average telephone in service during the year. The average per capita telephone use in the world outside the United States was only 16 calls during that year.

The telephone facilities at the disposal of the American public are far more extensive than those found abroad. In this country a greater proportion of the population in each community, whether large or small, has ready access to a telephone; a greater and more complete network of long distance wires and cables provides rapid and dependable voice communication from city to city; and overseas radiotelephone circuits bring nearly every important point in the civilized world within reach of the American telephone.

# FOR THE RECORD

## A. T. & T. VICE PRESIDENTS IN NATIONAL DEFENSE POSTS

Two Vice Presidents of the American Telephone and Telegraph Company, Frank B. Jewett and William H. Harrison, have been appointed to important posts in connection with the country's program of national defense. Dr. Jewett, who is also President of the Bell Telephone Laboratories, is serving as a member of the National Defense Research Committee. Mr. Harrison, Vice President and Chief Engineer, has been made Director of the construction division of the production department of the National Defense Advisory Commission, and is now on leave of absence from the telephone business.

The National Defense Research Committee, of which Dr. Jewett has been appointed a member, is empowered to correlate and support scientific research on the mechanisms and devices of warfare, to aid and supplement the experimental and research activities of the Army and Navy, and to conduct research for the creation and improvement of instrumentalities, methods, and materials of war.

Chairman of the committee is Dr. Vannevar Bush, President of the Carnegie Institution. Other members are Dr. James B. Conant, President of Harvard University; Dr. Karl T. Compton, President of Massachusetts Institute of Technology; Dr. Richard C. Tolman, of the California Institute of Technology; Conway P. Coe, U. S. Commissioner of Patents; Rear Admiral H. G. Bowen, of the Navy; and Brigadier General G. V. Strong, of the Army.

An initial division of the work of the committee has been made in five major groups under the supervision of the members, as follows: Armor and ordnance, Dr. Tolman, chairman; Bombs, fuels, gases, chemical problems, Dr. Conant, chairman; Communication and transportation, Dr. Jewett, chairman; Detection, controls, instruments, Dr. Compton, chairman; Patents and inventions, Commissioner Coe, chairman.

William S. Knudsen, who is in charge of correlating production under the national defense program, pointed out in announcing Mr. Harrison's appointment that he has had general direction of vast construction activities reaching into every state in the Union, thereby gaining a unique knowledge of the architectural and engineering professions and the building construction industry throughout the country. The appointment of Mr. Harrison conforms with Mr. Knudsen's policy of not selecting men from a particular industry to handle the responsibilities pertaining to their own business or profession, but rather men outside the industry who have had a broad experience with its problems, its personnel, and its facilities.

## DIRECTORS ARE RE-ELECTED AT ANNUAL MEETING

At the annual meeting of the American Telephone and Telegraph Company, held at 195 Broadway, New York City, on April 17, the Directors were re-elected. About 400 persons attended the meeting, and the total number of shares voted was

11,069,110. This represents 59.2 per cent of the outstanding stock; 52.9 of the stockholders voted by proxy or in person.

President Walter S. Gifford presided. In referring to the reduction of $5,300,000 in long distance rates which was to become effective on May 1, Mr. Gifford said:

"In some of the publicity following the announcement of this rate reduction, and occasionally from other sources, I get the impression that there are a few who believe that somehow we gain enough new business through these long distance rate reductions and secure sufficient mass production economies to leave the Company with substantially as good net earnings after the reduction as before. Some even suggest the net earnings will be more. I should like to take a few minutes of your time to give you the facts.

"Let us consider the new or additional business part of this conclusion first. If we make a rate reduction which amounts to, say, 20 per cent of our long distance gross revenue, it is a matter of arithmetic that we must secure in new business the equivalent of 25 per cent of our remaining revenue if we are to come out with the same total dollars of revenue with which we started. Even then, of course, as I will discuss in a moment, the Company would be far from having the same net earnings, since the 25 per cent increase in revenue could only come from an increased number of calls and each new call requires operators, switchboards, circuits, and men to maintain the facilities; that is, requires added expense. Still more than 25 per cent new business would be necessary, therefore, before the Company's former dollars of net earnings could be realized, and of course, if added plant investment were required to care for the increase in business, even more than the former net earnings would be needed to earn a return on this additional investment. The fact is that there is no basis in experience for the conclusion that anything like these amounts of new business are secured from a given reduction in long distance telephone rates.

"Secondly, our long distance business has different characteristics from those businesses to which the principle of mass production economies is applicable. Every long distance call which we handle is a separate and individual transaction. There must be operators available at each terminal to handle these calls, and, if it is a switched call, other operators at intermediate points. There must be switchboard capacity at each terminal, and sometimes at intermediate points. A substantial portion of the expense on long distance calls relates directly to this expense of handling the call, and the very nature of the business makes it impossible to get mass production economies as to this part of the expense.

"You may well ask then, 'How is it possible that we have made so many rate reductions over the last fourteen years?' or, stated another way, 'How have we obtained the necessary economies in over-all operation so as to make these many reductions possible?' The fact is that such economies have come about through two major contributions within the business. One is the continued development of cheaper and more efficient telephone plant, including transmission systems by which a large number of telephone channels can be provided over a single circuit; and the other is through improvements in administration and the operating job itself.

"The general thesis that we get all or even a large part of our money back from rate reductions through new business and mass production savings in expense is unsound. It has not been our experience, and we have had considerable experience with rate reductions over the years. Your management is satisfied that we recover through these sources only a small part of our loss; that for the long pull we must, as in the past, continue to depend

upon research and upon improvement in operations for reductions in costs; and that, in the long run, reductions in rates can be made only if and as such reductions in costs are realized. We shall continue our efforts along these lines to make telephone service more economical for the user."

# CONTRIBUTORS TO THIS ISSUE

FOLLOWING graduation from the University of Delaware with a B.S. degree, in 1911, CHARLES J. SCHAEFER, JR. was engaged in hydrographic and construction engineering for three years, when he entered the Bell System in the Traffic Department of The Bell Telephone Company of Pennsylvania at Philadelphia. Prior to his entering the military service as a regular army officer in 1917, he was an engineer on toll rates and toll engineering. Following the World War he resigned his commission as Captain of Artillery and returned to the Bell of Pennsylvania in the Personnel and Public Relations Department. In 1925 he was transferred to the American Telephone and Telegraph Company, where he is now Secretary of the Employees' Benefit Committee and Staff Assistant in the Personnel Relations Department. In addition to his participation in the development and administration of benefit, pension, and related activities, he has been Secretary of the Trustees of the Theodore N. Vail Memorial Fund and of the National Committee of Award for a number of years, and in this capacity has been especially interested in the recognition of outstanding public service as exemplified by the Vail Medal awards. He is the author of "The 'Plan for Employees' Pensions, Disability Benefits and Death Benefits' Completes Twenty-five Years of Service," which appeared in the QUARTERLY for January, 1938.

HAVING majored in Journalism, CLARENCE S. BOLEN was graduated by Ohio University, at Athens, O., in 1926 with the B.A. degree. After three years of newspaper work he joined the Public Relations Department of the Southern Bell Telephone and Telegraph Company at Atlanta in 1929. He became Editor of *The Southern Telephone News* in 1939. The photographs as well as the article about the recent Third Army maneuvers are the result of his pursuit of the Red and Blue armies through several states.

AFTER graduation from the University of Pennsylvania with the B.A. degree in 1910, PETER L. SCHAUBLE taught for three years. In 1913 he entered the Commercial Department of the Bell Telephone Company of Pennsylvania at Erie, and later served as local manager at Warren and at Erie. In 1919 he was transferred to the Public Relations Department in Philadelphia, was made Advertising Supervisor in 1922, and in 1927 became General Information Manager. As head of the Company's Public Relations Department, he was deeply interested in the part which communications played in the national convention to which Philadelphia played host last June.

SHORTLY before receiving the degree of B.E. from the University of Iowa in 1917, GLEN IRELAND entered the Army, serving for about two years as a signal officer in the Field Artillery. In 1919 he was employed by the Northwestern Bell Telephone Company (then the Iowa Telephone Company) on construction work. He was later transferred to the Engineering Department at Des Moines, where he became Division Transmission

Engineer. In 1923 he was transferred to the American Telephone and Telegraph Company in New York. There, in the Department of Operation and Engineering, he worked on toll transmission problems and later on equipment maintenance matters. He was appointed Transmission Engineer of the A. T. & T. Co. in 1939. Included in his interests, therefore, are matters which may affect telephone transmission—as did the magnetic disturbances of last March.

RECEIVING the B.A. degree from Lafayette College in 1907, and the LL.B. degree from New York Law School in 1909, ROBERTSON T. BARRETT practiced law until 1918, and for the next three years was engaged in newspaper work. In 1921 he joined the Information Department of the A. T. & T. Company, and since 1936 he has combined his duties in that department with those of Historical Librarian of the A. T. & T. Co. He is editor of the *Telephone Almanac,* and has contributed a number of articles to the QUARTERLY, the most recent being "The Telephone as a Social Force" in the issue for April, 1940.

BORN in Denmark, KNUD FICK was graduated in 1916 from Hellerup Gymnasium, near Copenhagen, with a degree corresponding to Bachelor of Arts, supplementing this two years later with the degree of Candidate of Philosophy from the University of Copenhagen. Following a number of years in the Foreign Office and other branches of the Danish Government, he joined the American Telephone and Telegraph Company in 1925. In the Chief Statistician's Division of the Comptroller's Department he has been in charge of statistics and economics relating to foreign telephone development. In 1932 he was sent to Madrid, Spain, and in 1938 to Cairo, Egypt, in connection with work for the International Telecommunication Conferences. His present discussion of what statistical analysis reveals about the world telephone situation —as of a year and a half ago—is his sixth annual contribution to the QUARTERLY on this topic.